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The economics of Managed Print and Imaging Services

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The Economics of Managed Print and Imaging Services

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June 2011

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To facilitate a baseline economic assessment, the concept of Managed Print and Imaging Services (MPIS) is introduced first. Next, a transferable process to determine the most economical print and imaging option is outlined so that NAVSISA, as well as other organizations, can utilize it. A baseline economic assessment of NAVSISA's current nonstandardized procurement and use of print and imaging services follows. This data is then compared to the total cost of ownership of a MPIS with state-of-the-art multifunction devices to conduct a cost-benefit analysis, which is subsequently used to determine the feasibility and potential savings a MPIS offers. In addition to the cost-benefit analysis, this project examines the cultural aspect of printing in an effort to reduce the demand for and waste of imaging resources.

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THE ECONOMICS OF MANAGED PRINT AND IMAGING SERVICES

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THE ECONOMICS OF MANAGED PRINT AND IMAGING SERVICES

ABSTRACT

To facilitate a baseline economic assessment, the concept of Managed Print and Imaging Services (MPIS) is introduced first. Next, a transferable process to determine the most economical print and imaging option is outlined so that NAVSISA, as well as other organizations, can utilize it. A baseline economic assessment of NAVSISA's current nonstandardized procurement and use of print and imaging services follows. This data is then compared to the total cost of ownership of a MPIS with state-of-the-art multifunction devices to conduct a cost-benefit analysis, which is subsequently used to determine the feasibility and potential savings a MPIS offers. In addition to the cost-benefit analysis, this project examines the cultural aspect of printing in an effort to reduce the demand for and waste of imaging resources.

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LIST OF ACRONYMS AND ABBREVIATIONS

C&A	Certification and Accreditation
CAC	Common Access Card
CIO	Chief Information Officer
CNO	Chief of Naval Operations
DoD	Department of Defense
DoN	Department of the Navy
DPI	Digital Printing and Imaging
DRMO	Defense Reutilization and Marketing Office
E-mail	Electronic Mail
FY	Fiscal Year
HP	Hewlett-Packard
ICE	Independent Cost Estimate
IM	Information Management
IT	Information Technology
MCS	Management Control System
MFD	Multi-Function Device
MPIS	Managed Print and Imaging Service
NAVSISA	Navy Supply Information Systems Activity
NAVSUP	Naval Supply Systems Command
NMCI	Navy / Marine Corps Intranet
OS	Operating System
PII	Personally Identifiable Information
PIN	Personal Identifiable Number
PMO	Print Management Objectives
RFI	Request for Information
TOC	Total Ownership Cost
U.S.	United States

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I. INTRODUCTION

A. BACKGROUND

The procurement and utilization of imaging hardware and its associated consumables are of particular concern to businesses and organizations because of the costs associated with the demand for print and copying services, and more importantly, the corresponding fiscal constraints these organizations are confronted with in today's economic environment. Imaging hardware that businesses typically use include printers, scanners, photocopiers, and fax machines, while consumables consists of items, such as paper, toner, and ink. Combined, the total cost of purchasing imaging hardware and consumables represents 3–5 percent of a company's revenues. For a company, such as Proctor & Gamble, that earns revenues of $76 billion annually, this equates to about 3.8 billion (Collett, 2010, p. 1). For the federal government, the amount spent annually on employee printing is about 1.3 billion (Lexmark, 2009, p. 1). To mitigate the effects of constrained or shrinking budgets, organizations have adopted efficiency initiatives along with a "do more with less" mentality. To achieve these ends, organizations have turned to Managed Print and Imaging Services (MPIS) as their preferred solution because it is an aspect of operating costs largely overlooked and ignored (Marshall, 2010, p. 20). While private corporations have been relatively swift to adopt MPIS as a viable method for achieving cost savings, federal organizations, such as the Department of Defense (DoD) and Department of the Navy (DoN), have been much slower to adopt this measure (Marshall, 2010, p. 1).

B. MANAGED PRINT AND IMAGING SERVICES

MPIS allows organizations to streamline and centralize their printing, copying, and imaging functions and represents a "strategy to monitor and control the flow of documents and their output" (Marshall, 2010, p. 1). MPIS is synonymous with other industry terms, such as print optimization and management, enterprise print management, and managed print service. MPIS is typically a three-pronged approach that seeks to

optimize the imaging and print environment by effectively utilizing both hardware and software while meticulously managing consumables. In this optimized state, a business can expect to achieve reduced operating costs, reduced downtime in hardware operating status, and improved workflow and employee efficiency (Collett, 2010, p. 1; Marshall, 2010, p. 1). Figure 1 is a graphical depiction of MPIS's approach to optimizing the print and imaging environment. Although great efficiencies can be achieved by addressing each prong independently, to take advantage of the synergy, and for a business to realize and capture all the benefits MPIS has to offer, the total system should be optimized.

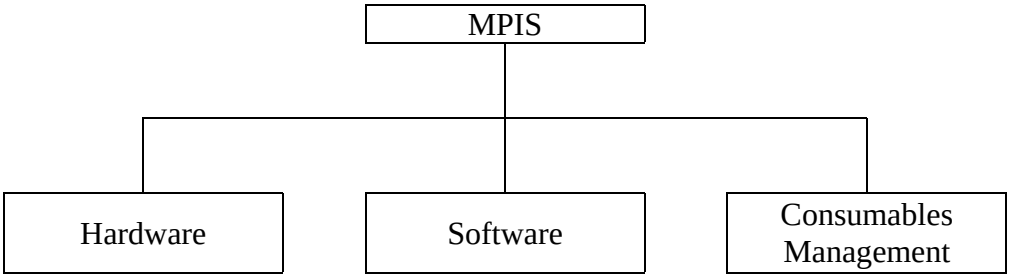

Figure 1. Three Pronged Approach to MPIS

1. Hardware

a. Match Technology to Needs

In terms of hardware, efficiencies are achieved through several avenues, the first of which is by matching the technological sophistication of the hardware to a business's functions and needs. On one end of the continuum, some small organizations (with a correspondingly low number of employees) require simpler devices, perhaps capable of just printing and copying. On the other end of the continuum, large multinational corporations might require the technological advantages afforded by multi-functional devices (MFD), capable of the full spectrum of imaging services to include printing, copying, scanning, faxing, and e-mailing. This full suite of services requires that the devices not only be networked to computers for printing purposes, but also to be connected to the network for Internet access to allow for the use of the e-mail function.

If the technological requirements are not properly matched to the businesses requirements, the scenario can end two different ways. First, if a company had a fleet of MFDs and did not need all of its capabilities, the dollars invested would be wasted on dormant and unused capabilities, akin to purchasing high-speed, 20 Mps Internet service for $60 just for checking e-mail, when a low priced dial-up option could have sufficed. Conversely, time, and therefore money, could be lost if a business's hardware fleet were comprised of many single function devices when only the functionality of MFDs was required.

b. Right Sizing

Of course, exceptions to the rule do occur and some smaller companies may still require MFDs coupled with Internet capability. In these particular cases, efficiency is achieved by decreasing the quantity of devices to a number suitable to the size of the workforce and workload. This right sizing of the hardware fleet to the business enterprise is the next manner in which to obtain efficiencies through hardware management. Next, several case studies are examined that benchmark the ratios of MPIS hardware to the numbers of employees. According to *Government Computer News*, the results of one study that surveyed 30 corporations showed that there was one printer for every two to three workers (Marshall, 2010, p. 1). Similarly, an assessment of Proctor & Gamble revealed that there were only four employees to every imaging device (Collett, 2010, p. 1). The industry standard, however, is to aim for a smaller ratio, typically, one device for every 15 to 20 people (Pharos.com, 2006, p. 3). If this ratio shifted from say 4 to 1 to 16 to 1, the organization could reduce the amount of hardware by approximately 75 percent.

By right sizing the hardware fleet, cost savings can begin to accrue through three different ways. First, a savings is achieved by eliminating 75 percent of the hardware fleet. Although the current hardware inventory in possession represents a sunk cost, the cost savings of having to buy less hardware to replace outdated or broken devices are reaped in the future. Savings are also garnered by a reduction in maintenance fees for a correspondingly smaller hardware inventory.

The second way right sizing accrues cost savings is by purchasing less consumables. In general terms, less hardware means less consumables used, and therefore, purchased. However, are cost savings still realized if the output required is still the same? Keeping all things equal except for hardware reduction, suppose that a company still needed to print the same number of pages, say 60,000. Further, suppose that this company previously had 20 desktop printers, each with a print yield of 600 black and white pages per cartridge. At a cost of $35 per cartridge, to reach the 60,000-page output required, it would cost a total of $3,500. On the other hand, for a MFD, a single toner drum with a print yield of 60,000 pages would cost $100. This equates to a savings of $3,400 per month. A moderately priced MFD costs approximately $3,500. Thus, although the upfront cost of purchasing a MFD outweighs the purchase of 20 desktop printers (average price of $100), cost savings are easily achieved within the first month of operation.

The final way right sizing can lead to cost savings is through decreased energy use. With less devices plugged in and drawing power, energy use declines proportionally. Furthermore, with advancing technology, today's devices consume less energy than those from a previous generation. Currently, some MFDs use the same or less energy than a desktop printer. In the example used above, assuming that the MFD has the same output as the desktop printer, energy consumption is reduced by a factor of 20 (going from 20 devices to just one MFD) to achieve the same 60,000 print yield. Over a large enterprise, the cumulative savings may be sizable. Consequently, it is not surprising that based on industry analysis, the typical energy reduction a company can expect to achieve is approximately 30–40 percent (Collett, 2010, p. 1).

c. Homogenizing Hardware

A third way to achieve hardware efficiency is by homogenizing the fleet of devices within an organization. It is not uncommon for businesses to possess a hodgepodge of imaging devices (Collett, 2010, p. 1). This scenario is typical in many businesses and organizations with decentralized purchasing authority. Thus, although a centralized purchasing department might actually perform the mechanics of making

purchases, other departments within an organization might possibly have the autonomy to purchase what and how much they want within their budgeting constraints. When it comes to managing the print environment, this distributed purchasing power, along with an absent MPIS policy, represents the number one reason why so much heterogeneity exists within an organization's hardware fleet (Marshall, 2010, p. 1). Accordingly, the organization can appear as separate, independently operating entities, instead of a unified entity capable of taking advantage of its pooled resources.

For example, consider a Navy shore command that has the following departments: executive, operations, engineering, and supply. Without an overarching MPIS policy in place, which fewer than 10 percent of organizations have (Marshall, 2010, p. 1), each department can theoretically purchase printers and copiers different from the other departments and within each department itself. The operations department may have a preference for Toshiba printers, with the engineering department preferring Xerox, while the supply department favors something different from both and buys HP. Each department, of course, also must purchase consumables for the respective hardware. Suppose a month passes and each department begins printing end-of-month reports for the Commanding Officer. Each department runs out of ink and desperately looks to the other departments for some help. Hence, the obvious problem is that none of the departments has ink, and even if they do, the ink cartridges are incompatible with the other makes of printers.

After the scolding that each department head receives, each one vows never to run out of ink and orders a year's supply. During this time, the supply department head is replaced, and within a month, the printer breaks. This particular department head especially liked the Kyocera printer used at a last command, and despite the purchasing agent's recommendation to buy another HP printer, a Kyocera is purchased, as well as a year's supply of ink. Thus, 11 months' worth of printer ink exists that the previous HP printer used because the former department head had purchased an HP printer that used a specific toner cartridge incompatible with any other printers, to include the other HP printer models within the department. As time progresses, and as

this scenario repeats many times, and throughout the various other departments, the amount of money wasted on unused consumables due to the mismanagement of hardware steadily increases. This problem is further magnified in larger commands or larger corporations as the sheer number of people and departments increases the opportunities for these inefficiencies to occur.

Homogenizing hardware can also lead to increases in efficiency by reducing the user's learning curve, which decreases the amount of time required for training. Although the average user is probably not going to be inconvenienced by having to use several imaging devices of different makes or models, efficiency is gained nevertheless. Additionally, repair and maintenance is easier on a homogenous fleet, which can lead to more savings in both cost and time.

2. Software

The second prong of the MPIS approach is the utilization of software that serves as the command and control center for the hardware fleet. While there are tangible benefits to be gained from using MFDs capable of copying, printing, scanning, faxing, and e-mailing, the strength of a MPIS does not rest solely on the technological advantages of the hardware. A real strength of a MPIS is derived from the functionality and utility of the software, which controls and monitors the performance of the hardware, regardless of make or manufacturer, while allowing the organization to analyze its usage and habits within its print environment.

This scenario is analogous to a person who purchases a computer. Despite owning the latest, state-of-the-art computer, the inherent power of the computer (hardware) cannot be harnessed without the software. Suppose this person wanted to track personal finances. Without a specially designed software package to track finances, this person is relegated to designing and using a spreadsheet program, and its sophistication will be a function of the user's skill and ability with that particular program. However, if this

person had a software program specifically designed for recording personal finances (like Quicken), it would undoubtedly be easier to measure and analyze financial habits by using the tools provided by the program.

MPIS software works in much the same way. After installation of the MPIS software, the first step is to use the software to gather usage data, which allows for the analysis of the current print environment. With data compiled, an organization can begin to measure the print output and how much is being spent to support that output. The software can also capture a very precise level of detail, capable of showing usage for each device and user within an organization. The metrics generated can establish a baseline usage level and can serve as a real eye opener to the members of the organization and can also be leveraged as a tool for change.

The power of the software also lies in its ability to control the print environment. The MPIS software uses Print Management Objectives (PMOs) to alter the behavior of the end user (Copiers.Toshiba.com, p. 2). PMO is essentially a policy driven, rules-based software engine that optimizes printing behavior by encouraging or forcing a certain print behavior. For example, if a user prints a document, the software triggers a pop-up screen on the monitor that prompts the user to print on both sides of the paper (if it has not already been set as the default). Figures 2 and 3 are examples of PMO interactive pop-up screens informing the user of the consequences of print actions.

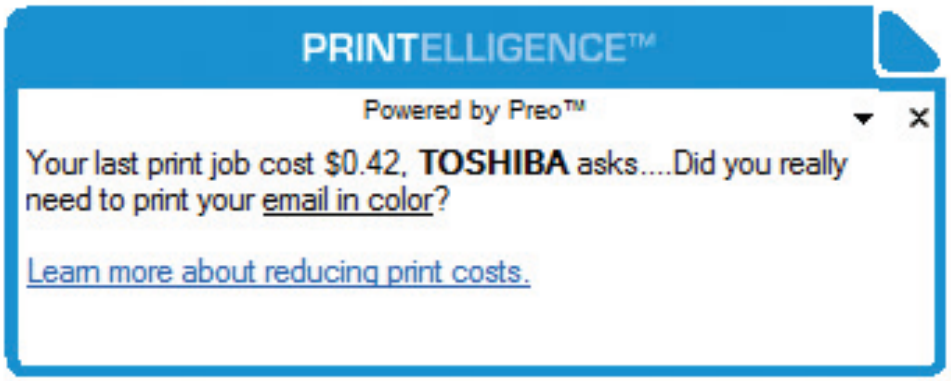

Figure 2. Print Management Objectives Pop-Up Example 1 (From Copiers.Toshiba.com, p. 2).

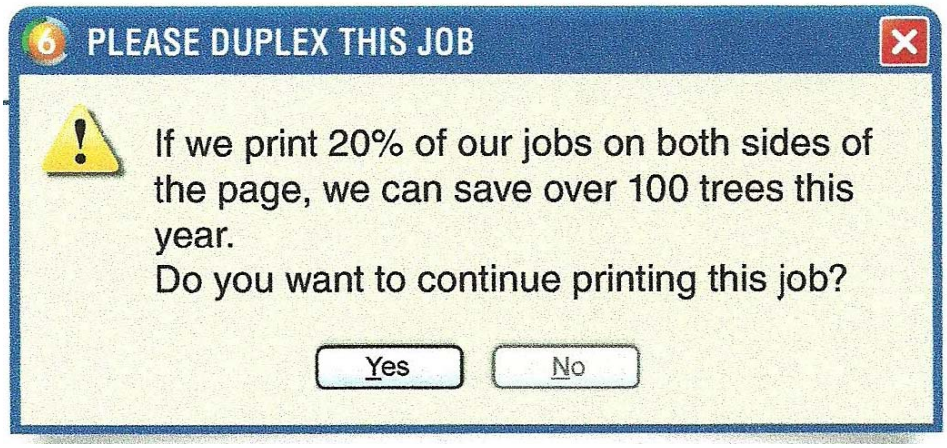

Figure 3. Print Management Objectives Pop-Up Example 2 (From Printaudit.com, p. 2).

3. Consumables

The third prong of MPIS is consumables management. In a print environment, the aspect of consumables management can stand alone as an independent variable that could yield significant cost savings with proper management. One strategy to manage consumables is centralized control over the management of hardware (to facilitate homogeneity) and purchasing for ink and toner, which can prevent stockpiling and out-of-control purchasing habits typically exhibited by organizations with decentralized purchasing authority (Marshall, 2010, p. 1).

Once hardware and software are purchased, consumables represent the largest costs associated with the print environment because their costs are recurring (Pharos.com, 2006, p. 3). However, if the proper hardware and software are in place, consumables management can become a function of the efficient utilization of both hardware and software, thus magnifying the ease with which consumables can be managed. For instance, by taking advantage of the latest hardware and software technologies, an organization can begin to duplex print by default. If an organization had a print volume of 60,000 pages and still needed to print that volume on a monthly basis, duplex printing would decrease the amount of paper used by 50 percent. In addition, as shown in a

previous example, using the appropriate device could reduce the amount of toner cartridges needed from 100 to just one. Furthermore, with rules-based printing, print jobs could be decreased, which leads to less paper and ink waste and more dollars saved.

With the three prongs of a MPIS in place, a business enterprise can expect the following results.

- A streamlined hardware fleet
- Improved hardware utilization rates
- A reduction in consumables inventory and consumption
- An understanding of printing habits and trends
- The ability to determine who is printing what and how many copies
- A clear understanding of cost outlays
- The ability to control and manage the print and imaging environment
- The capability to alter print behavior
- Improved employee efficiency

When the above benefits are quantified in terms of what the major industry providers claim they can provide organizations via MPIS, the results are as follows.

- An average cost savings of 30–40 percent (Copiers.Toshiba.com, p. 2)
- A reduction in energy use and green house gases by 44 percent (xerox.com, 2010a, p. 5)
- A reduction in total ownership cost (TOC) of 30 percent (xerox.com, 2010a, p. 3)
- A reduction in printing costs of up to 75 percent through rules-based printing (Copiers.Toshiba.com, p. 2)
- Zero loss of print jobs (Copiers.Toshiba.com, p. 2)
- Improved workflow of 30 percent (Copiers.Toshiba.com, p. 2)

4. The MPIS Process

Once an organization decides to implement a MPIS and chooses a provider for the service, the organization can expect the following general steps.

a. Step One

Software installation into the current printing network. This step is critical and allows the MPIS provider to begin the process of running a discovery of the current print environment. This process can take anywhere from two weeks to two months.

b. Step Two

Gather data and begin benchmarking/analyzing the results. With the software operational, electronic data mining can begin and information, such as print volume, device usage, and user usage, becomes available to be analyzed and used to paint a picture of the current print environment later. By gathering data, an organization can begin to get "a handle on what's actually going on [and then] begin to control costs" (Pharos.com, 2006, p. 3). Since managing the print environment usually represents the last frontier of cost savings for an organization, usually no historical record of usage exists (Collett, 2010, p. 1). As such, "in most companies, a giant chasm exists between the printing devices executives think they have and what they actually have. Many businesses run between two and five times as many devices as they think they operate" (Pharos.com, p. 3).

c. Step Three

Be presented with an optimized print environment solution based on historical data gathered and a projection of cost savings derived from the software model. Information, such as who is printing what and how much, will be available, as well as device usage and employee to hardware ratio. "The software will also help [the] business calculate printing costs and determine where the potential for costs savings is the highest" (Pharos.com, p. 3). Knowing this, a business can make a plan to do the following.

- Remove excess equipment
- Optimize the remaining equipment
- Eliminate reports that printers generate and no one reads
- Review the aspects of printing in [the] organization
- Begin to take advantage of savings

So, who are the providers of this service? The MPIS providers in the industry are categorized into two broad categories: those that are hardware based and those that are software based. The hardware-based providers are easily recognizable businesses that have been involved in the office and print and imaging scene for quite some time. They include such corporations as Toshiba, HP, Xerox, and Lexmark. The forte of these companies lies in their asset base and in their research and development department, which continuously fuels the advances in their technology. Their expertise in this field has allowed them to create MFDs with a wide range of capabilities that use consistently less and less resources in the way of energy and materials, such as ink, as well as plastics for toner cartridges.

However, as previously mentioned, while tremendous advantages and efficiencies can be gained from the technological advances in the hardware alone, the brains of the hardware fleet are contained within the software system. For this reason, software-based companies have become invaluable. The need for this specific type of software has spawned several software companies that specialize in MPIS, such as Pharos Systems, Ringdale, Print Audit, and Preo. With software companies in the mix with traditional hardware companies, a competitive arena is created, giving organizations that seek MPIS more options in choosing a provider. This scenario is not unlike the cell phone industry, in which a hardware provider, such as Motorola, can sell its cell phones (hardware) running different types of software, say for example, a Windows operating system (OS) or an Android OS. However, unlike the cell phone industry, a software provider for MPIS (if chosen) can provide the hardware to its clients. The software company can then simply purchase the hardware and install its software to form its own complete MPIS package.

d. Step Four

Once an organization has the information from Step Three, it can determine the level of service it desires. MPIS can be as extensive as the customer desires because it can be tailored to fit each independent customer's needs. With MPIS, a customer can outsource some or all aspects of the management of its printing and

imaging requirements to one of the many corporations mentioned above (Collett, 2010, p. 1), which is done through a contract awarded based on a competitive bidding process. This outsourcing and competitive bidding process helps reduce imaging costs. Since the scope of a MPIS system is based on the customer's desires, this contract can vary drastically. Therefore, the two ends of the contract spectrum are examined since an infinite number of combinations can exist. First, on one end of the spectrum, a MPIS could be as simple as renting or purchasing the imaging hardware. However, more commonly, organizations tend toward the other end of the spectrum in which the contract includes not only hardware, but also onsite maintenance that handles everything from filling the machine with paper and ink, to clearing jams, and even making major repairs to the device. However, a "true MP[I]S provider offers much more than just a maintenance and ink-and-toner-replacement contract. This is a contract with a third party that almost plays an advisory role to you" (Collett, 2010, p. 1). Additionally, some organizations even have the MPIS provider monitor and report each employee's use of imaging resources. Ultimately, "they provide continuous monitoring of your environment and know where the output is going, how much is being used by different departments and what type of output is being produced" (Collett, 2010, p. 1).

5. Why Managing the Print and Imaging Environment Is Significant

Reducing consumption for imaging hardware and consumables should be considered because of the potential cost savings generated for an organization. Some would agree that imaging services is an ideal example of previously overlooked opportunities for cost savings. Patrick Marshall, a writer for *Government Computer News* phrased this best in his article, "Managed Printing is an Obvious But Overlooked Way to Cut Costs, Improve Efficiency, and Bolster Security," where he called the cost avoidance due to better management of imaging resources the "low-hanging fruit that has largely gone ignored" (Marshall, 2010, p. 1). To find anecdotal evidence to support this statement, take a minute, look around an office, command, or installation and think about how much the outdated, excess, and nonstandardized hardware is costing the organization.

6. Corporate Examples

Several multinational corporations have already discovered this fact about outdated, excess, and nonstandardized hardware and have taken steps to manage it. Specifically, Proctor and Gamble has implemented a MPIS that has allowed it to consolidate and centralize its printing and copying services. Costs associated with imaging hardware and consumables have decreased by 25 percent, which amounts to millions of dollars in savings per year. Like most companies, Proctor and Gamble spends between three and five percent of their revenue on imaging services, which equates to $3.8 billion in 2008. Equally impressive was the sheer reduction in the number of devices in its printing and copying fleet from 45,000 devices to less than 10,000. Proctor and Gamble is not alone as other corporations also desire to exploit costs savings in these areas (Collett, 2010, p. 1).

Another example of the benefits MPIS can deliver is British Telecom, one of the world leaders in communications services, which operates in over 170 countries, employees 96,000 workers, and operates from over 600 sites. In an effort to improve its business practices and increase cost savings, it initiated a MPIS program that focused on reviewing its printing, scanning, and copying devices. It hired Xerox and "within the context of British Telecom's business requirements for document production, the team looked at how best to use the fleet to reduce costs and carbon footprint without sacrificing the quality and efficiency of enterprise print services." The results were as follows (xerox.com, 2010b, p. 2).

- A savings of $10.4 million
- A 40 percent savings on print and imaging costs
- A more efficient ratio of users per printing device (from eight to 25)
- A 50 percent reduction in carbon footprint

7. Government Examples and Support

While government organizations are not profit seeking like private entities, they still need to monitor costs closely and actively try to keep them to a minimum. One such

example is the city of Minneapolis, Minnesota. In 2008, the city had an inventory of 1,023 printers and 193 copiers or MFDs in 16 departments that serviced 2,518 computers. A pilot program was conducted with the Human Resources Department that had 40 employees and 32 devices—nearly a device per employee. With the successful implementation of a MPIS, the department reduced its 32 devices by a factor of 10, and operated with three MFDs. The "operational cost savings came in at an astounding 73 percent—lowering their annual cost by more than $49,000." Aside from reducing costs, the reduction in waste allowed the city to comply with its Green Initiative (Copiers.Toshiba.com, p. 2).

Overall, however, the federal government has been slower to implement MPIS, which is starting to change given the results achieved by the private sector; the government is beginning to approach MPIS providers actively in hopes of reaping similar benefits. In January 24, 2011, the Department of Education issued a request for information (RFI), solicitation number ED-CIO-RFI-2011, "in an effort to conduct market research for potential sources that may have the technical capability to meet its requirements and develop and provide potential solutions for managed print services." It was specifically looking into printing, copying, faxing, scanning and digital sending (Fedbizopps.gov, 2011, p. 1).

The DoN and the DoD on the whole have started taking notice of these areas of possible costs savings and are taking steps to follow the examples set by Proctor and Gamble and others in the corporate world. Two motivations are currently helping to accelerate this initiative in the DoN. First, better management of imaging hardware and consumables is an excellent way to meet Secretary of Defense Gates' budget cuts as his cuts call for obtaining "more bang for the buck by shifting resources from overhead to the military capabilities needed today and in the future" (Hedgpeth, 2010, p. 1). Therefore, by decreasing overhead costs, which is exactly what imaging costs are, that money can then be spent on both sustaining troops and modernizing and recapitalizing military equipment.

Also, by adopting these corporately developed best practices, the Navy can help meet the Chief of Naval Operations' (CNO) Fiscal Year (FY) 2011 Commanders Guidance concerning energy savings and TOC initiatives (United States, Department of Defense, 2010b). For example, in NAVSUP's November/December 2009 Monthly Update, the NAVSUP Command Science Advisor singled out technology as a major area for improvement of energy efficiency and fiscal resource allocation (Gallagher, 2009, p. 7). Preliminary research also supports this as NAVSISA predicts that it alone can implement measures to cut its printing and copying costs by $200,000 to $300,000 a year, or approximately 70 percent over a three-year period (United States, Department of Defense, 2010a).

In 2009, the government contracted Lexmark to study this issue, and it found that the federal government spends about $1.3 billion annually on employee printing, and of that $1.3 billion, Lexmark assessed that $440.4 million was spent on unnecessary printing. In other words, each federal employee on average prints about 7,200 pages per year, and of these pages, approximately 2,500 are unnecessary. Additionally, Lexmark found that approximately 2,500 pages, or 35 percent of those 7,200 pages, were discarded the same day they were printed. Lexmark also estimated that the federal government printed roughly 18.8 trillion pages a year, and if even the smallest improvements were made to decrease the roughly 6.6 trillion pages of waste per year, the federal government could avoid approximately $1 million in printing costs per day (Lexmark, 2009, p. 6).

As a part of the federal government, the Navy is undoubtedly a contributor to the waste associated with a mismanaged print environment. Therefore, the next chapter presents a methodology for Navy commands to conduct an analysis of their current print environment by allowing them to conduct an in-house, independent cost estimate (ICE). The results will depict a cost-benefit analysis on the feasibility of implementing a MPIS. Additionally, the ICE can be used as points of comparison against providers of MPIS.

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II. OUTLINE OF TRANSFERABLE PROCESS

A. CHAPTER OVERVIEW

This chapter identifies a process for commands to conduct an ICE that enables them to compare the cost of their nonmanaged print and imaging to that of a MPIS. To facilitate this, a three-phase process was created: Phase 1 is comprised of steps management must complete to initiate this assessment; Phase 2 consists of information the assessment team must acquire to conduct Phase 3; and Phase 3 is the resulting cost comparison.

B. PHASE 1 OF THE INDEPENDENT COST ESTIMATE

Phase 1 is composed of three steps that management must complete following its determination to do an ICE for establishing a MPIS. First, it must identify an assessment team that possesses the appropriate skills and knowledge. A senior individual should be identified as the team lead. Next, the team should consist of someone with extensive firsthand knowledge of the command's imaging hardware. Additionally, the team will require someone with knowledge of contracts. Lastly, the team should have an individual with some form of formal economic and cost estimation training.

Secondly, management must identify the scope of the project. For example, is the MPIS for only one office or the entire command? Next, management should track the number of man hours invested in the cost assessment. While not required, it is a good business practice to document the level of effort expended on a project.

	Step	Start Process	Result	Notes
Phase 1	**1**	Identify an Assessment Team		**Identified By Management**
	2	Identify Scope		
	3	Track Cost Assessment		

Figure 4. Phase 1 of Independent Cost Estimate

C. PHASE 2—CURRENT IMAGING SYSTEM

Before beginning Phase 2 of the ICE for assessing the current imaging system and its associated refresh costs, be aware the following list of steps concerns common costs most organization could incur. However, some costs unique to an organization may exist that must be added to this process. This process is a guide that an organization can modify based on its needs.

Phase 2 is comprised of the steps that must be performed to assess the current imaging system environment.

Step 1 is to count the number of printing devices within the organization. This total can also be used to determine the user ratio, which is calculated by dividing the number of devices by the number of users (for example, 100 devices divided by 300 users is equal to a 1 to 3 ratio), which can later be used for comparison purposes.

Step 2 is to estimate the total price of the devices. If the actual price of the devices is listed in a contract, then that dollar figure can be used. If that information is not readily available, an Internet search of the make and model number is a way to estimate the cost of a device, which than can be used to estimate the total cost of imaging devices.

Step 3 is to determine the rate at which the printers are refreshed (typically 3–5 years). Refresh is defined as the periodic replacement of aging hardware (both in terms of chronological age and technological age).

Step 4 is to estimate ink costs for the year, which can be conducted in several ways. If the purchasing department keeps detailed records, this information can be found relatively easily. If the purchasing department does not have an accurate figure due to bundled buying (multiple types of products on a single order, for example, ink, pens, folders, which can make parsing out very time consuming) or due to inaccurate or incomplete records, a baseline tracking study must be performed. If manpower or time constraints are not an issue, then parsing out ink purchases from a receipt is a viable, albeit time consuming option. To obtain accurate numbers and to rule out seasonal spikes

(such as end-of-fiscal-year buys), it is recommended that a three-month time period be used. Once this dollar figure is obtained, simply multiply that number by 4 to ascertain the annual total.

Step 5 is to estimate the number of pages printed by the organization per year. As with determining the ink usage, a three-month period is recommended. The most accurate way to determine use is to remove all paper from the printers and restock them with a predetermined inventory reserve. As printers run out of paper and need to be refilled, it should be utilized from the predetermined reserve. This inventory should be controlled and distributed by a responsible custodian to maintain accuracy of the records. At the end of the three-month discovery period, simply take the starting inventory, subtract the remaining inventory, and add back the remaining paper in the printers. Take this figure and multiply it by 4 to obtain the annual paper usage figures. The annual figures should also be divided by 5,000 to determine how many boxes are used.

Step 6 is to estimate what the organization pays for a box of paper, which will later be used to calculate the organization's total paper costs.

Step 7 is to estimate the cost to the paper usage. Take the cost of a box of paper (typically about $40) and multiply it by the number of boxes used, which yields the annual cost of paper.

Step 8 is to estimate the maintenance cost per year. If the cost is incorporated to an existing contract, it is then possible to ascertain this number. If maintenance is not part of the printing or copying contract, purchasing should have records. Once again, if purchasing does not have complete or accurate records, conduct a three-month discovery effort to obtain an annual cost for maintenance.

Step 9 is to estimate how much the maintenance-person costs the organization. If a maintenance person is not dedicated to the print and imaging devices and the only maintenance is secured through a third party, then the costs are captured in Step 8. However, if a person in the organization is responsible for maintaining the equipment, this individual's wrap rate is the cost. Wrap rate is the full cost of that individual. The

rate includes not only salary but also additional costs, such as fringe benefits (Aboutfreelancewriting.com, 2005, p. 1). If a person is designated as the maintenance person as a collateral duty, then make a reasonable estimate in percentage terms of how much the maintenance collateral duty comprises this individual's work time. Multiply this percentage by the wrap rate for that individual.

Step 10 concerns the cost of wall drops. Most organizations will not incur any wall-drop installation costs as the required wall-drops or required Ethernet jacks are likely to already be in place supporting the current imaging system.

Step 11 determine the monthly service cost for each wall-drop and multiply this monthly figure by 12 to obtain the annual cost for a wall-drop and then finally multiply this by the total number of drops required.

Step 12 ascertains the costs associated with device installation. Simply take the number of devices to be installed by the cost of each installation if it can be determined from a contract. This amount would be zero if it were captured in Step 9 as part of the maintenance-person cost.

Step 13, Certification and Accreditation (C&A), will usually be zero because the organization is simply refreshing an older device. If this is not the case, multiply the number of devices requiring C&A by $33,000, which is the estimated cost of C&A for a MPIS.

Step 14, training, in the current imaging environment, is rarely conducted on how to use the printing devices effectively and is, therefore, usually $0. However, if training is actually required, then use the following formula to estimate training costs.

$$\text{Total Training Cost} = \frac{\text{Number of Employees} \times \text{Length of Training in Hours}}{\text{8 Hours in a Work Day} / \text{240 Work Days in a Year}} \times \text{Average Wrap Rate of Employee}$$

By multiplying the number of employees trained by the length of training, the total number of hours required for training is obtained. This number is required in terms of years as government employees tend to be paid a salary as opposed to an hourly wage.

For this reason, divide by the 8 hours in a workday to obtain days and then divide by 240 workdays in a year, which is a standard work year after accounting for weekends, holidays, vacation time, and sick time (Lexmark, 2009, p. 4). Finally, multiply this number by the average wrap rate (wrap rate is explained in Step 9) of all employees to ascertain the total training costs. For example, see Step 14 in Chapter III.

For Step 15, use the following formula to estimate the energy costs.

Number of Devices	X	(	(95% X Sleep Power Use)	+	(5% X Print Power Use)	X	)	24 (Hours)	X	365 Days	/	1000 Watts per KW	X	Electricity Cost				

This equation assumes a device spends approximately 95 percent of the time in sleep mode and 5 percent of the time printing (Pharos.com, 2006, p. 2.). The power consumption of the device can be determined by conducting an online search of the device's characteristics. Multiply this number by 24 hours and 365 days to determine the cost for the year and the power use data will be provided in hours. Additionally, the information will be provided in watts. Therefore, divide this number by 1,000 to obtain kilowatts. Lastly, multiply this number by the cost of a kilowatt-hour of electricity. If the local rate is unknown, it is possible to use 10 cents, as it is the average cost of a kilowatt-hour of electricity in the United States (United States, Department of Energy, 2011, p. 1). For a practical application of this step, see Step 15 in Chapter III.

Step 16 concerns storage costs. Most organizations will not incur any storage costs as the consumables simply remain within the confines of the organization's building or warehouse if available. However, if a storage room or a warehouse were not available, then the cost would be whatever amount was paid to secure a storage area, such as in a DLA warehouse. Most commands, however, already have storage areas that can be used. Thus, the costs for this line item is $0.

Step 17 concerns disposal costs. For most commands, disposal costs are also $0 because the command would simply turn the items into the Defense Reutilization and Marketing Office (DRMO). If costs would be incurred, it would likely be for the rent of a truck for transporting the hardware devices.

	Step	Required Info	Result	Notes
	Current Imaging System			To Be Determined by Assessment Team
Phase 2	1	# of Printers/Copiers at Organization		See Phase 2 of Chapter II for Detailed Instructions on How to Calculate Each Line Item
	2	Total Cost of Devices		
	3	Refresh Cycle		
	4	Ink costs Per Year		
	5	# of Pages Printed by Organization Per Year		
	6	Cost of Paper Per Box		
	7	Paper Cost Per Year		
	8	Maintenance Cost Per Year		
	9	Maintenance-Person Cost		
	10	Total Wall-Drop Installation Cost		
	11	Total Wall-Drop Service Per Year		
	12	Device Installation Costs		
	13	Certification and Accreditation Costs		
	14	Training Costs		
	15	Energy Costs		
	16	Storage Costs		
	17	Disposal Costs		

Figure 5. Phase 2 of Independent Cost Estimate for Current Imaging System

D. PHASE 2—MANAGED PRINT AND IMAGING SERVICES

For Step 18, record the number of people in the organization. For management information, divide Step 18 by Step 1 to determine the current device to user ratio. This ratio is not required for the ICE but is a valuable piece of information to provide management. If the organization has less than 20 people, a MPIS is definitely not warranted because with a 20 to 1 user to device ratio, an organization with less than 20 people would require one MFD. Therefore, should the one device that is required fail, no redundancy would exist and the organization would not have any imaging capabilities.

Note: A device to user ratio of 20 to 1 was selected. Should an organization determine a different ratio would best suit its needs, such as 15 to 1 or 25 to 1, use that ratio. Once again, this process is only a guide and can be changed to meet specific originations' requirements.

In Step 19, enter the organization's building footprint or area in square feet (Area = Length x Width).

Step 20 determines the number of MFDs needed to service the organization optimally. For Step 20, choose the higher of the number of people divided by 20 (the result of Step 18 divided by 20) or the total square feet of the building divided by 7,850 sq. ft. For current printing contracts, a black and white printer must be available to every employee within 50 ft. The square footage of an area with a 50 ft. radius is equal to approximately 7,850 sq. ft. Therefore, for every 7,850 sq. ft., a minimum of one printing device is required.

Step 21 is to obtain at least two bids from MPIS providers to serve as a comparison between their prices and their levels of service.

For Step 22, obtain the price for the preferred MFD and multiply that by the result in Step 20 to provide the total cost for the hardware devices needed. This figure will also be used to compare the prices proposed by the two different contract bidders.

Step 23, to estimate the ink costs to be used in the MPIS environment, calculate how many toner drums would be required to support the number of pages printed per year (obtained in Step 4). To obtain this, divide the pages printed in Step 4 by how many pages each drums yields and finally multiply this by the cost per drum.

Step 24, paper costs, should be approximately 75 percent of the current system. Simply enter 75 percent or .75 of the result from Step 5. Since duplexing is set as the default for the new MFDs, a reduction in paper usage will occur. A strict adherence to duplexing would reduce the paper volume used by 50 percent, but given that some reports might require single sided printing, it is safe to estimate a moderate reduction of 25 percent.

Step 25, if MFD maintenance costs for all three years are identified in the contract, simply use that value. If it is not part of the contract, this cost can be estimated by multiplying the total device cost by 50 percent or .5. The 50-percent level was determined to be appropriate as MFDs have a one-year warranty included and 25 percent a year on maintenance.

Step 26, if maintenance-person costs are identified in the contract, simply use that value, if not, this cost can be determined in a similar manner as in Step 8.

Step 27, total wall-drop installation costs, can be determined using the same process as in Step 10.

Similarly, Step 28, total wall-drop service cost, can be determined using the same process as in Step 11.

Step 29, the installation cost per MFD, can be obtained from the contract bids. Enter this number into Step 29 and multiply that number by the number of MFDs recorded in Step 20. The total device installation cost is provided, which is then entered into Step 29.

Step 30, enter the number of devices that require C&A, multiplied by $33,000, which is the approximate cost of C&A per device.

Step 31, calculate the training costs, by using the formula and process described in Step 14. This represents the cost to train the workforce on how to use the new MFDs and how to use the PMO software that guide the employee's print behavior.

Step 32, calculate the energy costs, using the same formula and process shown in Step 15 utilizing the power use characteristic of the MFDs.

Step 33, the intangible costs, such as lost productivity and decreased morale of changing to MFDs, can vary significantly from organization to organization. Each specific organization must determine this individually. A good example of these intangible costs is having to walk and retrieve a document from the MFD instead of having it print out at someone's desk. The following formula can be used to calculate this common form of intangible cost.

Intangible Costs of Changing to MFDs =

Number of Pages	/	Avg. Pages per Print Job	X	Avg. Time Lost per Print Job in Minutes	/	60 Minutes in an Hour	/	8 hours in a day	/	240 Work Days in a Year	X	Average Wrap Rate of Employees

Steps 34 and 35 are likely not applicable in a MPIS contract but should an organization incur these costs, they can be entered here.

	Step	Required Info	Result	Notes
	Managed Print And Imaging Service			To Be Determined by Assessment Team
Phase 2	18	# of People at Organization		Can Be Obtained Using Similar Processes Described in Steps for Current Imaging Process or From the MPIS Contract Bids.
	19	Organizations Footprint in sq. ft.		
	20	Determine # of MFDs Needed		
	21	Get Bids From at Least Two Different Providers		
	22	Cost of MFDs		
	23	Cost of Ink		
	24	Cost of Paper		
	25	MFD Maintenance Cost		
	26	Maintenance-Person Cost		
	27	Total Wall-Drop Installation Cost		
	28	Total Wall-Drop Service Per Year		
	29	Total Device Installation Cost		
	30	Certification and Accreditation Costs		
	31	Training Costs		
	32	Energy Cost		
	33	Intangible Costs of Changing to MFDs		
	34	Storage Costs		
	35	Disposal Costs		

Figure 6. Phase 2 of Independent Cost Estimate for Managed Print and Imaging Service

E. PHASE 3—COMPARISON

Phase 3 of the ICE simply takes the values calculated in Phase 2 and puts them conveniently in a table so that they can be summed. There is only one column for MPIS values, as it is felt that one bid should be selected over the other, and then compared against the current system; however, to compare the current system against both MPIS bids, simply create a second identical MPIS column. Note: All annual costs need to be multiplied by refresh cycle, as this will be the period for which an organization is doing the cost comparison. Specifically, Lines 2, 3, 4 (current system only), 5, 7, 11, 12, and 13 must be multiplied by the number of years in the refresh cycle. Once these items have been summed, the resulting values can be used to make decisions concerning implementing a MPIS.

	Step	Cost Comparison	Current	MPIS
Phase 3	**1**	Cost of Devices		
	2	Cost of Ink		
	3	Paper Costs		
	4	Maintenance Cost		
	5	Maintenance-Person Cost		
	6	Wall-Drop Installation Costs		
	7	Wall-Drop Service		
	8	Installation Costs		
	9	Certification and Accreditation Costs		
	10	Training Costs		
	11	Energy Cost		
	12	Intangible Costs of Changing To MFDs		
	13	Storage Costs		
	14	Disposal Costs		
	Total			

Figure 7. Phase 3 of Independent Cost Estimate

III. PROCESS APPLIED TO NAVSISA

A. CHAPTER OVERVIEW

This chapter utilizes the three-phase process outlined in the previous chapter to conduct an ICE to ascertain if implementing a MPIS at NAVSISA is cost effective.

B. NAVY SUPPLY INFORMATION SYSTEMS ACTIVITY BACKGROUND

In early 2010, the Navy Supply Information System Activity (NAVSISA) considered implementing a MPIS system to determine its viability in the DoN, but to this day, NAVSISA has not been granted approval to conduct what it calls a "MPIS Pilot Program." NAVSISA tried to mitigate the cost of the MPIS pilot program by conducting it in conjunction with its previously scheduled periodic refresh of imaging hardware. Specifically, refresh is the periodic replacement of equipment to ensure continual performance. For example, if a command procures a new printer, it must examine its expected service life, say three to five years, and use that number to establish a refresh plan to budget funds for a new printer when the original printer is at the end of its service life.

NAVSISA is an Echelon III command that supports the Navy's supply command, Naval Supply Systems Command (NAVSUP). NAVSISA achieves this level of support by being the Navy's Information Technology (IT) provider and is responsible for designing, developing, and maintaining information systems while supporting numerous activities in the functional areas of logistics, supply chain management, transportation, finance, and accounting. How both NAVSISA's mission and vision statements tie into the implementation of a MPIS is explained as follows (NAVSUP.Navy.mil, 2010).

1. NAVSISA's Mission Statement

NAVSISA delivers Information Technology/Information Management (IT/IM) solutions with specific emphasis on logistics and financial related products and services (NAVSUP.Navy.mil, 2010).

2. NAVSISA's Vision Statement

NAVSISA's goal is to be the IT/IM solution provider of choice delivering best value products and services in full partnership with its stakeholders (NAVSUP.Navy.mil, 2010). MPIS is a program that embodies NAVSISA's mission and vision statements, as it offers an IT solution that could potentially deliver cost savings to the stakeholders.

C. PHASE 1 OF THE INDEPENDENT COST ESTIMATE

The purpose of this phase is to identify and establish an assessment team responsible for conducting the ICE. Figure 8 identifies the results of the three steps in this process. As part of Phase 1, NAVSISA first identified its assessment team. The team included a program manager to lead the team, an IT application support specialist, and the command's information technology specialist. Second, the scope of this project was limited with respect to offices observed to facilitate a more manageable and expeditious assessment and implementation of changes. The offices observed to gather data on the cost of imaging resources was limited to NAVSISA Buildings 310, 407, and 409 in Mechanicsburg, Pennsylvania. These buildings were selected because of their tracking of procurement and use of imaging resources, such as ink and paper, which provided the data to do an ICE. Next, the tracking of man hours invested in the cost assessment is in progress and ongoing as this process will not be completed until the conclusion of the ICE.

	Step	Start Process	Result	Notes
Phase 1	**1**	Identify an Assessment Team	Complete	**Identified By Management**
	2	Identify Scope	Complete	
	3	Track Cost Assessment	In Progress	

Figure 8. Phase 1 of Independent Cost Estimate for NAVSISA

D. PHASE 2—CURRENT IMAGING SYSTEM FOR NAVSISA

The purpose of this phase is to quantify and record the costs associated with operating the current imaging system for NAVSISA.

Step 1, NAVSISA has 228 imaging devices in Buildings 310, 407, and 409.

Step 2, the total cost of devices is $342,000, which is equal to the $1,500 average price per device multiplied by the 228 devices at NAVSISA.

Step 3, the refresh cycle is three years.

Step 4, annual ink costs are $89,324.

Step 5, NAVSISA prints approximately 2,000,000 pages per year, which is equal to 400 boxes of paper, and at the $40 per box identified in Step 6, the total estimated paper cost per year in Step 7 is $16,000.

Step 8, a maintenance cost (for equipment) per year of $10,322, was estimated based on 2010 maintenance cost data, which was provided by NAVSISA.

Step 9, the maintenance-person cost per year is $100,000, which is based on doubling the maintenance-person's salary of $50,000 dollars to obtain the person's wrap rate. Doubling a person's salary approximates the person's wrap rate because an employee costs approximately as much in benefits as the cost in salary (Aboutfreelancewriting.com, 2005, p. 1).

Step 10, the total wall-drop or Ethernet jack installation cost, would be zero in this case because NAVSISA is simply maintaining the status quo by refreshing one imaging device with a newer model of the same device.

Step 11, the total cost of wall-drops service per year, is $55,440 or $35 a month times the 12 months in a year times 132 as 132 of NAVSISA's 228 imaging devices are networked.

Step 12, the costs associated with device installations, was $114,684 ($503 flat contracted installation cost per device multiplied by the 228 devices).

For Step 13, the cost is zero as the devices have already been through the C&A requirements given NAVSISA is only refreshing the devices it already possesses.

Step 14 is zero as training is not required to maintain the status quo.

For Step 15, using the following formula, which was described in the previous chapter, the current yearly energy costs can be estimated as $11,285.

Total Energy Costs Per Year =

Number of Devices X ((95% X Sleep Power Use) + (5% X Print Power Use)) X 24 (Hours) X 365 Days / 1000 Watts per KW X 10 Cents

This step used the power usage characteristics of the Xerox Phaser 6360 Laser Printer because it is the most abundant device in NAVSISA's hardware fleet. First, there are 228 devices. It is estimated that the device spends approximately 95 percent of the time in sleep mode at 20 watts and 5 percent of the time printing at 750 watts, which was then multiplied by 24 hours and 365 days the cost for the year was being determined and the power use data was provided in hours. Additionally, the information was provided in watts. Therefore, it was necessary to divide this by 1,000 to get kilowatts, which lastly, was multiplied by 10 cents, the average cost of a kilowatt-hour of electricity in Pennsylvania (United States, Department of Energy, 2011, p. 1).

Step 16, we determined NAVSISA storage costs to be zero, given the storage room would otherwise be left vacant as there is currently no other use for it. The authors' acknowledge that realistically this is not the case as everything has a cost. However, due to the relatively low dollar value of the cost (which would not affect our conclusion) we argue that it is appropriate to estimate this cost as zero. However, this may not be the case in all instances.

Step 17, NAVSISA's disposal costs, are zero as the device is removed as part of the installation of the new device, which falls under Step 12.

Figure 9 identifies the results from Steps 1–17 based on data provided by NAVSISA.

	Step	Required Info	Result	Notes
	Current Imaging System			To Be Determined by Assessment Team
Phase 2	1	# of Printers/Copiers at Organization	228	See Phase 2 of Chapter 2 for Detailed Instructions on How to Calculate Each Line Item
	2	Total Cost of Devices	342,000	
	3	Refresh Cycle	3	
	4	Ink costs Per Year	89,324	
	5	# of Pages Printed by Organization Per Year	2,000,000	
	6	Cost of Paper Per Box	40	
	7	Paper Cost Per Year	16,000	
	8	Maintenance Cost Per Year	10,322	
	9	Maintenance-Person Cost	100,000	
	10	Total Wall-Drop Installation Cost	0	
	11	Total Wall-Drop Service Per Year	55,440	
	12	Device Installation Costs	114,684	
	13	Certification and Accreditation Costs	0	
	14	Training Costs	0	
	15	Energy Costs	11,285	
	16	Storage Costs	0	
	17	Disposal Costs	0	

Figure 9. Phase 2 of Independent Cost Estimate for Current Imaging System for NAVSISA

E. PHASE 2—MANAGED PRINT AND IMAGING SERVICES FOR NAVSISA

The purpose of this phase is to quantify and record the costs associated with implementing a MPIS for NAVSISA. Before presenting Phase 2 of the ICE for MPIS, note that a device to user ratio of 20 to 1 was selected. This is the ratio that NAVSISA determined would be optimal for its organization (United States, Department of Defense, 2010a, p. 3).

Step 18, NAVSISA has 869 employees located in Buildings 310, 407, and 409.

Step 19, NAVSISA's footprint of the three buildings is 162,000 sq. ft. (Building 310: 100 ft. by 140 ft. or 14,000 sq. ft., Building 407: 140 ft. by 200 ft. or 28,000 sq. ft., and Building 409: 200 ft. by 600 ft. or 120,000 sq. ft.)

Step 20, by dividing the number of NAVSISA employees by 20, the result obtained is a requirement of 43 MFDs. When dividing the footprint of the three buildings, 162,000 sq. ft., by the requirement that one device must be within 50 feet of every

employee or one device per 7,850 sq. ft., 21 MFDs are required. This requirement for 21 MFDs is superseded by the 43 MFDs required by the 20:1 user to device ratio. Therefore, 43 MFDs are required.

Step 21, is complete as NAVSISA has obtained bids from MPIS providers.

Step 22, the cost of 43 MFDs is $142,000.

Step 23, the cost of ink per year is $33,287.

Step 24, as explained in Step 24 of Chapter II, it is estimated that 75 percent as much paper would be required due to the more efficient printing protocols a MPIS utilizes. Therefore, the MPIS paper costs would be $12,000.

Step 25, based on industry standards, the maintenance cost for three years is estimated to be $71,000 or 50 percent of the total device cost, which results in 25 percent per year for maintenance for years two and three with the device being covered by warranty the first year.

Step 26, NAVSISA's maintenance-person costs, would be zero as it would be factored into Step 25.

Step 27, the total wall-drop installation cost, would be zero in this case because NAVSISA already has 132 networked drops installed, which could be utilized for the 43 MFDs.

Step 28, the total cost of wall-drops service per year, is $18,060 or the $35 a month service fee times the 12 months in a year times the 43 MFDs that would be networked.

Step 29, the total installation costs, are $21,629 or $503 for each of the 43 MFDs.

Step 30, C&A would be required because the MFDs identified in this contract are not currently on the NMCI Certified Device List. Specifically, two devices would require C&A, one color and one black and white, which equals $66,000 in estimated C&A costs.

Step 31, the training costs were estimated as $45,260 using the following formula.

Total Training Cost =

Number of Employees	X	Length of Training in Hours	/	8 Hours in a Work Day	/	240 Work Days in a Year	X	Average Wrap Rate of Employees

To obtain the total man hours required for training, multiply the number of employees by the length of the training. In NAVSISA's case, the 869 employees were multiplied by one hour, as the training would be one hour long. To adjust the calculation to an annual basis, the total hours are divided by the 8 hours in a workday to obtain days and then divided by 240 workdays in a year. The standard work year is 240 days after accounting for weekends, holidays, vacation time, and sick time. Finally, this number is multiplied by the $100,000 average wrap rate of all NAVSISA's employees to ascertain the total estimated training costs. Once again, wrap rate is estimated by doubling a person's salary because an employee costs just about as much in benefits as the individual costs in salary.

Step 32, using the following formula, which was described in the previous chapter, MPIS yearly energy costs can be estimated at $1,989.

Total Energy Costs Per Year =

Number of Devices	+	(	(95% X Sleep Power Use)	+	(5% X Print Power Use)	)	X	24 (Hours)	X	365 Days	/	1000 Watts per KW	X	10 Cents

This step used the power usage characteristics of the HP LaserJet M3035, as this is the most abundant MFD in the MPIS contract. There will be 43 MFDs, and it is estimated the device will spend 95 percent of the time in sleep mode at 24 watts and 5 percent of the time printing at 600 watts. This number was then multiplied by 24 hours and 365 days as the cost for the year was being determined and the power use data was provided in hours. Additionally, the information was provided in watts. Therefore, it was necessary to divide this by 1,000 to obtain kilowatts. Lastly, this number was multiplied by 10 cents (the average cost of a kilowatt-hour of electricity in Pennsylvania according to the Department of Energy) (United States, Department of Energy, 2011, p. 1).

Step 33, the intangible cost of switching to a MPIS was estimated as $34,722 using the following formula.

Intangible Costs of Changing to MFDs =

Number of Pages	/	Avg. Pages per Print Job	X	Avg. Time Lost per Print Job in Minutes	/	60 Minutes in an Hour	/	8 hours in a day	/	240 Work Days in a Year	X	Average Wrap Rate of Employees

NAVSISA prints two million pages per year with the average job being approximately five pages (United States, Department of Defense, 2010a, p. 1). However, it is estimated that only 10 percent of these 400,000 print jobs are incurring an intangible cost since approximately 90 percent of NAVSISA's employees are currently already printing to communal networked printers. Therefore, only the 10 percent of employees with printers at their desk will be inconvenienced by needing to walk to a network printer. It was also estimated that each print job would result in the loss of one minute of productivity due to walking farther and waiting at the MFD for a job. These total minutes lost were converted into lost work years using the previously determined method and multiply this number by the average $100,000 wrap rate of NAVSISA employees.

Steps 34 and 35 are not applicable in this MPIS contract and are, therefore, zero.

Figure 10 identifies the results from Steps 18–35 based on data contained in the MPIS contract bids as provided by NAVSISA.

	Step	Required Info	Result	Notes
	Managed Print And Imaging Service			To Be Determined by Assessment Team
Phase 2	18	# of People at Organization	869	Can Be Obtained Using Similar Processes Described in Steps for Current Imaging Process or From the MPIS Contract Bids.
	19	Organizations Footprint In sq. ft.	162,000	
	20	Determine # of MFDs Needed	43	
	21	Get Bids From At Least Two Different Providers	Complete	
	22	Cost of MFDs	142,000	
	23	Cost of Ink	33,287	
	24	Cost of Paper	12,000	
	25	MFD Maintenance Cost	71,000	
	26	Maintenance-Person Cost	0	
	27	Total Wall-Drop Installation Cost	0	
	28	Total Wall-Drop Service Per Year	18,060	
	29	Total Device Installation Cost	21,629	
	30	Certification and Accreditation Costs	66,000	
	31	Training Costs	45,260	
	32	Energy Cost	1,989	
	33	Intangible Costs of Changing to MFDs	34,722	
	34	Storage Costs	0	
	35	Disposal Costs	0	

Figure 10. Phase 2 of Independent Cost Estimate for Managed Print and Imaging Service for NAVSISA

F. PHASE 3—COST COMPARISON FOR NAVSISA

The purpose of this phase is to compare the results from Phase 2 so that stakeholders can make an informed decision on whether or not to implement a MPIS.

Remember: All annual costs need to be multiplied by refresh cycle, as this will be the period of the cost comparison. Specifically, Lines 2, 3, 4 (current system only), 5, 7, 11, 12, and 13 need to be multiplied by the number of years in the refresh cycle.

By inputting the values from Phase 2 into Phase 3 and summing the numbers, as shown in Figure 11, it can be seen that implementing a MPIS in Buildings 310, 407, and 409, NAVSISA would save an estimated $657,734 or 50 percent, over the three-year period, which would equal approximately $219,244 in cost savings per year.

	Step	Cost Comparison	Current	MPIS
Phase 3	1	Cost of Devices	342,000	142,000
	2	Cost of Ink	267,972	99,861
	3	Paper Costs	48,000	36,000
	4	Maintenance Cost	30,966	71,000
	5	Maintenance-Person Cost	300,000	0
	6	Wall-Drop Installation Costs	0	0
	7	Wall-Drop Service	166,320	54,180
	8	Installation Costs	114,684	21,629
	9	Certification and Accreditation Costs	0	66,000
	10	Training Costs	0	45,260
	11	Energy Cost	33,855	5,967
	12	Intangible Costs Of Changing To MFDs	0	104,166
	13	Storage Costs	0	0
	14	Disposal Costs	0	0
	Total		**1,303,797**	**646,063**

Figure 11. Phase 3 of Independent Cost Estimate for NAVSISA

IV. EFFICIENTLY USING IMAGING RESOURCES

A. CHAPTER OVERVIEW

This chapter addresses the issue of improving the procurement process for imaging hardware and consumables, while decreasing the demand for their consumption. Management Control Systems (MCS) and nudges are the two principles used in this chapter to address the issue of using valuable imaging resources more efficiently. The second edition of Kenneth A. Merchant and Wim A. Van der Stede's, *Management Control Systems: Performance Measurement, Evaluation and Incentives*, is used as a guide to management control systems. This text was chosen because these two authors are internationally renowned as leaders in the field of management control and this text is widely considered an excellent guide to MCS (Merchant & Van der Stede, 2007, back cover). Richard H. Thaler and Cass R. Sunstein's, *Nudge*, was chosen as the second method to address this issue because the authors are recognized as leaders in the field of behavioral science and, more specifically, the concept of choice architecture (Thaler & Sunstein, 2009, back cover).

B. MANAGEMENT CONTROL SYSTEMS

1. Management Control Systems Defined

The concept of management control revolves around the notion of inducing employees to behave appropriately by influencing their behaviors in desirable ways. This type of incentive results in employees acting in the best interests of the organization, which ultimately supports the organization in achieving its goals (Merchant & Van der Stede, 2007, p. 5).

2. The Current Procurement Management Control System

The current open purchase process relies on what is known as action controls, which are the most direct form of management control because proactive steps are taken that ensure employees act in an organization's best interests by making their actions the

focus of control (Merchant & Van der Stede, 2007, p. 76). Four basic forms of action controls exist, which include behavioral constraints, preaction reviews, action accountability, and redundancy (Merchant & Van der Stede, 2007, pp. 76–79). The current open purchase procurement process utilizes all four of these forms. Behavioral constraints occur in the form of administrative constraints because the open purchase procurement process limits the employee's ability to procure imaging hardware and consumables independently. Also, this current MCS demonstrates the behavioral constraint concept of separation of duties because the person who routes the order form is different from the people who approve or disapprove it, who, in turn, are different from the people who actually process and procure the approved items. This process also provides several layers of redundant reviews.

The combination of administrative constraints and separation of duties seen in the open purchase process are called poka-yokes, which are methods to prevent mistakes. This combination of controls is designed to make a system foolproof because it takes steps to ensure the process is adhered to by forcing one action be completed before the next action can be taken. Furthermore, in the open purchase process, the chain of command through which the order form is routed for approval, disapproval, or modification is a form of preaction review because as the order form is routed through the chain of command, the higher levels can review the recommendation of those who reviewed it previously. Finally, such a well-documented system facilitates action accountability because the order form serves as an auditable paper trail. During inspections of the open purchase program, inspectors are able to determine discrepancies or complete procedural compliance. In either case, employees can be held accountable for these outcomes and are either reprimanded or praised based on the determination.

3. Issues With the Current Management Control System

The problem with the current MCS is that not all aspects of the system are controlled and the aspects that do have controls placed on them are insufficient. We could not identify any controls that ensure both the economical allocation of printing and copying funds while addressing the issue of reducing consumption. Currently, both the

procurement process and the use of imaging hardware and consumables would be referred to as what Merchant and Van der Stede call “out-of-control” because the current system of controls does not have a high probability of ensuring that employees procure and utilize imaging resources in an ideal fashion (Merchant & Van der Stede, 2007, p. 11). This fact is demonstrated at NAVSISA, which has over 25 different models of imaging devices and each requires its own specific consumable requirements, when, in actuality, two models are sufficient. As will be established, it is not currently possible to identify any steps in the current system that ensures employees maximize energy, economies of scale, TOC, and equipment user efficiencies. While more controls or more stringent controls are not always ideal, in this situation, these controls may prevent such problems as a lack of direction, motivation, and personal limitations.

First, lack of direction can be seen by organizations paying little attention to, and giving even less guidance, on this issue (Merchant & Van der Stede, 2007, p. 8). In addition to the authors’ research, both NAVSISA’s *MPIS business case* and Lexmark’s study on government printing, stress this lack of direction and guidance (Lexmark, 2009, p. 1; United States, Department of Defense, 2010a, p. 5). Secondly, it is important to highlight that what little incentives are in place often conflict with other incentives, such as employees’ self-interest because employees may act in their own self-interest at the expense of the organization’s interests (Merchant & Van der Stede, 2007, pp. 9–10). For example, people act in their own self-interest by engaging in what is known as effort aversion. An example of effort aversion is employees printing their own personal copy of a document because they do not want to retrieve the office copy.

Thirdly, the current system creates personal limitations because it does not provide an adequate level of training, experience, knowledge, and information (Merchant & Van der Stede, 2007, pp. 10–11). Often in commands, no one from the most junior Sailor to the Commanding Officer, knows which combination of hardware and consumables are the most economical based on the command’s needs because the

printing environment frequently goes unchecked (Pharos.com, 2006, p. 2). Finally, action controls are mainly preventive measures; in other words, they do a poor job of detecting undesirable behaviors (Merchant & Van der Stede, 2007, p. 80).

Therefore, current action controls need to be more stringent and new forms of personnel control and cultural control need to be added. By making these additions, the MCS would become more proactive, along with establishing reactive measures that better prevent undesirable behaviors.

4. Recommendations for Improvements

Improving the MCS involves improving the action controls, while adding forms of personnel controls and cultural controls because these three forms of control working in combination yield better results than using one form of control by itself. By making these changes and achieving a more optimal level of control, it is more likely, but not a guarantee, that the system will achieve its goals because perfect control does not exist (Merchant & Van der Stede, 2007, p. 11).

First, implementing tighter administrative and physical forms of behavioral action controls are examined so that fiscal resources are better allocated and consumption is reduced. One of the methods that Merchant and Van der Stede propose to improve administrative behavioral controls is through avoidance, or eliminating the possibility of control problems by centralizing the process (Merchant & Van der Stede, 2007, p. 14). This type of control may prove beneficial in imaging hardware and consumables procurement, as the current system does not standardize the procurement of printers and copiers. As presented previously, the lack of standardization has resulted in NAVSISA utilizing 28 different imaging devices. Secondly, better imaging resource allocation may be facilitated by reducing the list of possible devices that can be procured by departments and divisions to the most efficient alternatives.

Administrative forms of behavioral action controls alone will not solve the problem of efficient imaging resource allocation. Physical action controls can also be implemented to decrease consumption of imaging resources. For example, at the Naval

Postgraduate School's Dudley Knox Library, students must log on to printing control stations to execute printing jobs they previously put in a queue from their personal workstations. This system is not the only one of its kind as systems exist that require an identification card be swiped, as opposed to logging on with a personal identification number (PIN). Additionally, this added step can act as a form of preaction review because users then know that they may have accidently printed a 100-page document instead of only a two-page document, or that they accidently printed multiple copies of a document. When this physical form of behavioral constraint is combined with software that has the ability to track an individual's use of imaging devices, reports can be generated for that individual's use, as well as supervisorial review as a form of action accountability.

Next, personnel controls present an excellent method of improving the MCS for procurement and use of imaging resources. Two forms of personnel controls presented by Merchant and Van der Stede that may prove beneficial in this system are training and job design, or the provision of necessary resources.

First, people must be trained on such imaging hardware capabilities as duplex, print preview, and multiple pages or slides per sheet functions. When these functions are utilized appropriately, they prove very beneficial to an organization by being immensely cost-effective. Efficient printing techniques not only decrease paper and ink consumption, but also extend the service life of imaging hardware. Additionally, imaging resources can be saved if people use projectors during briefs, as opposed to giving each individual a printout of the brief. In addition to these steps, people could use electronic routing software and electronic document libraries instead of the hard copy paper process alternatives (Merchant & Van der Stede, 2007, pp. 83–84).

Second, organizations doing adequate job design and provision of necessary resources are instrumental in facilitating the achievement of their goals. In this particular MCS, this means implementing new and more efficient multifunction devices that print, scan, fax, and e-mail, as opposed to inefficient legacy devices that only do one of these functions. This implementation also facilitates reducing the number of devices in an

office because new multifunction devices can support 10 to 20 people per device, vice the two to five people per legacy device (Collett, 2010, p. 2). Design also plays a key role and NAVSISA has determined that it could decrease its current 67 devices in Codes 91 and 94 of Building 409 to just 10 by utilizing multifunction devices and strategically locating them (United States, Department of Defense, 2010a, p. 5).

Lastly, cultural controls present an excellent method of improving the MCS for procurement and use of imaging resources. Two of the cultural controls aspects that Merchant and Van der Stede focus on are codes of conduct and cultural awareness. Cultural controls have the potential to be so effective in the Navy because culture tends to play such a dominant role in naval identity, given that the role-shared traditions, norms, beliefs, values, ideologies, and attitudes affect the manner in which the Navy conducts business. For cultural controls to be successful in this system, managers must find and stress several concepts to help motivate employees to accept such notions as efficient printing. A couple quick examples are stressing to service members the notion of responsibility to taxpayers and the environment. Knowing that some people will not accept this concept, the manager can also show how efficient printing can benefit the individual. One way in which conservation benefits the employee is through the spending of money saved on printing costs on items that employees desire more than imaging services (Merchant & Van der Stede, 2007, pp. 85–86).

C. NUDGE

1. The Nudge Philosophy Defined

Now that the issue of improving the allocation of funds for imaging hardware and consumables has been addressed, while decreasing the demand for consumption using the principals of the MCS, another manner in which to examine this issue is using the concept of nudges. A nudge "is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2009, p. 6). Central to this concept of nudges is the premise of combining "the notions that people should be free to do what

they like or opt out of undesirable arrangements, if they want to do so, and it is legitimate for choice architects to try to influence people's behavior in order to make their lives longer, healthier, and better" (Thaler & Sunstein, 2009, p. 5). The key to this premise is that choices should be influenced in a way that will make choosers better off, as judged by themselves.

It is important to indicate that people need nudges because they are humans that predictably err and not econs that form unbiased forecasts (Thaler & Sunstein, 2009, p. 7). This assumption that humans are econs, which states that each human thinks and chooses unfailingly well, is not reality, which is why homo sapiens partake in drugs, for example (Thaler & Sunstein, 2009, p. 7). Yet another important distinction is the notion that humans are affected by nudges while econs are not, whereas both humans and econs respond to incentives (Thaler & Sunstein, 2009, p. 8). The authors of *Nudge*, Thaler and Sunstein, cover the differences between humans and econs in three chapters entitled: "biases and blunder," "resisting temptation," and "following the herd."

a. Biases and Blunders

First, "biases and blunders" illustrate the differences between the automatic and reflective systems. Humans rely heavily on the automatic system, or gut reactions, to facilitate rapid instinctive responses in the decision-making process (Thaler & Sunstein, 2009, p. 21). Econs, on the other hand, rely on the more deliberate reflective system, which is often associated with thinking and self-conscious responses (Thaler & Sunstein, 2009, p. 20). These differences mean that humans are susceptible to heuristics, or rules of thumb, such as the following.

- Availability and representative heuristic
- Optimism and overconfidence
- Gains and losses
- Status quo bias
- Framing

Therefore, the more a decision is contemplated, the more likely it is that humans will overcome these susceptibilities and make the best decision.

b. Resisting Temptation

The second chapter that discusses the differences between humans and econs is "resisting temptation." In this chapter, Thaler and Sunstein continue using the automatic and reflective systems but introduce the notion that a doer is controlled by an automatic system, while a planner is controlled by a reflective system. Consequently, based on Thaler and Sunsteins' research, humans are doers and not planners that demonstrate dynamic inconsistencies, which include struggling with temptation, mindlessness, self-control, and mental accounting (Thaler & Sunstein, 2009, pp. 41–45).

c. Following the Herd

The third chapter that discusses the differences between humans and econs is "following the herd." In this chapter, the authors emphasize that their research finds humans, unlike econs, are susceptible to three forms of social influence: information, peer pressure, and the hinting to an idea or concept known as priming (Thaler & Sunstein, 2009, p. 73). Some forms of these social influences that the book identifies are collective conservatism or tradition, pluralistic ignorance or the bandwagon effect, the spotlight effect or notion that you think people are paying more attention to you than they actually are, and priming (Thaler & Sunstein, 2009, pp. 58–70).

Finally, returning to the definition of a nudge and the fact that a humans' choice can be affected, the concept of a neutral choice design does not exist. The people who can affect or nudge the choices of humans, or doers that rely on their automatic system, are called choice architects. Thaler and Sunstein describe a choice architect as a person who "has the responsibility for organizing the context in which people make decisions" (Thaler & Sunstein, 2009, p. 3). Therefore, a choice architect can influence or nudge the decisions of other humans by the way they present or display that choice. The

authors identify six principles of good choice architecture that should help prevent humans from erring. A letter from each of these six principles is used to form NUDGES (Thaler & Sunstein, 2009, p. 102).

I**N**ncentives

Understand mapping

Defaults

Give feedback

Expect error

Structure complex choices

2. The Nudge Philosophy Applied

Now that the "nudge philosophy" has been described, the concept of utilizing nudges to induce people to take certain actions is discussed. These concepts will influence the governance system so that it becomes more cybernetic, or controlled, and therefore, appropriated funds may be more efficiently employed. Thaler and Sunstein stress that the government is not populated by econs, but rather by humans that err, which means that every command has at least two issues in common (Thaler & Sunstein, 2009, p. 82). First, opportunities to use the concept of nudges are examined to lead these employees to choose more economical procurement methods for printing and copying services. Second, these same concepts are used to lead employees to reduce their consumption of printing and copying resources.

3. The Nudge Philosophy Applied to the Issue of Procurement

The first issue that every command faces because the U.S. Government employs humans, and not econs, is the economical allocation of printing and copying funds. The three ways in which humans fail in the efficient procurement of imaging resources are economies of scale, energy efficiency, and TOC.

a. Economies of Scale Issue

The first inefficiency of the procurement process is that the current system fails to account for the economies of scale for imaging hardware and consumables. As described previously, the purchasing authority is typically distributed within a Navy organization; in other words, each department has the autonomy to purchase what it wants within its budget constraints. The departments are then able to purchase different types of imaging hardware as long as it appears on the NMCI approved device list, which could potentially lead to an extremely varied hardware fleet in terms of makes, models, and types. Standardization and centralization may prove beneficial in imaging hardware and consumables procurement as the current system does not standardize and centralize the procurement of printers and copiers because print and scan capabilities fall under information technologies management, while copy and fax capabilities fall under facilities management. Since devices now exist that combine all four of these capabilities into one machine, procurement should be controlled by one organization in an effort to promote efficiency and decrease needless redundancy.

b. Total Ownership Cost (TOC) Issue

The second inefficiency of the procurement process is the current system's failure to account for the TOC of imaging hardware and consumables. As previously mentioned, employees often lack the training, experience, knowledge, and information to make an informed decision. Additionally, it is not enough to have many choices available and then hope people choose wisely (Thaler & Sunstein, 2009, p. 208). Rarely do commands calculate TOC when purchasing imaging hardware because it can prove to be a tedious and difficult process. Therefore, in the majority of commands, no one, from the most junior Sailor to the Commanding Officer, knows which combination of hardware and consumables is the most economical.

Specifically, the current procurement process fails to account for the energy consumption of imaging hardware. As Thaler and Sunstein indicate, this is because the most energy efficient hardware is also rarely the lowest priced. Thus, energy

efficient hardware becomes what is called investment goods because the costs are borne up front at the time of purchase while the benefits are delayed and recognized throughout the goods' life (Thaler & Sunstein, 2009, p. 75). A problem is thus created with the current choice architecture because hardware ordering information usually only provides employees with the purchase price and not energy and ink use for example.

To nudge employees in the direction of more efficiently using funds associated with imaging resources, a couple steps can be taken to improve the situation. First, energy use characteristics should be requested from the vendor so that choices can be reduced to only the most efficient models. The authors call this step a simplifying strategy because the numerous and diverse choices available need to be scaled down (Thaler & Sunstein, 2009, p. 158) to account for the employees' lack of training, experience, knowledge, and information to make the most informed decision (Thaler & Sunstein, 2009, p. 97).

Next, not only should the energy use characteristics be requested and analyzed, but models should also be compared concerning their energy and ink use costs per year. The authors call this concept framing, and it focuses on the way information is presented. Framing says that not only should this information be provided, but it should be provided in such a manner that it tells the employee that it will cost them X number of dollars vice saving them X number of dollars because humans are affected twice as much by losing a dollar then by gaining that same dollar (Thaler & Sunstein, 2009, p. 37).

Two other nudges that the authors present in this book that could help control this flaw is through websites and defaults. For example, websites have proven to be powerful nudges in the past, particularly with respect to prescription drugs and Medicare Part D. Due to the complexity and vast number of available options, the government created a website that allowed people to input their information, such as what drugs they were taking, the size of the dose, and the frequency of the dose, and after submitted, the website would provide the three best options based on their specific situation. A similar website could prove immensely valuable if used to nudge employees in ordering imaging hardware and consumables. An employee would just need to enter

such information as the device needs to support X number of people, have X number of capabilities, do X pages per minute, and last X number of years. Based on the information entered, the website would be able to calculate the device with the lowest TOC, given such things as the devices cost, the energy it uses, cost of ink, expected maintenance costs, and service life.

While creating a website can be difficult and time consuming, a simpler nudge may be what the authors phrase as setting a default, which acts as powerful nudges because humans are susceptible to loss aversion and mindless choosing. Additionally, whether correctly or incorrectly, people assume that default options come with an implicit endorsement from the choice default setter (Thaler & Sunstein, 2009, p. 35). Thus, by setting the default device as the most economical device, humans are more likely to make the best choice, while still being able to choose another device if they viewed a different device as better for their organization.

4. The Nudge Philosophy Applied to the Issue of Use

The second issue the concept of nudges can be applied to is reducing an employee's consumption of printing and copying resources. Nudges can prove very beneficial in this tragedy of the commons type situation because some people tend to act in their own best interests and not in the best interests of the organization because some people tend to consume more than otherwise necessary since they do not have to actually pay for imaging services themselves (Thaler & Sunstein, 2009, p. 186). This view is a result of what the authors refer to as improperly aligned incentives because employees often act in their own self-interest at the expense of the organization's interests (Thaler & Sunstein, 2009, p. 187). As previously mentioned, an example of people acting in their own self-interest is by engaging in effort aversion. Nudges can improve this tragedy of the commons type issue in two ways, through RECAP and social influences.

a. RECAP

RECAP is an acronym that the authors discuss in the book, and it stands for **R**ecord, **E**valuate, and **C**ompare **A**lternative **P**rices (Thaler & Sunstein, 2009, p. 95).

RECAP could be a powerful nudge, as it would give employees an incentive to not consume more than is absolutely necessary because as the R in record implies, everyone's use of imaging resources would be tracked. Once again, the photocopy room in the Dudley Knox Library at the Naval Postgraduate School is a great example of tracking the consumption of imaging resources of its employees (in this case, students). As described in the management control system section, the system forces students to log on to printing control stations to execute print jobs they previously put into a queue from their personal workstations. This system not only states the name of the file being printed, but how many jobs in the print queue and the number of pages of each job.

The record piece of RECAP becomes an even bigger nudge when the employees know that their record of use will be evaluated. The book recommends multiple methods of review, such as review by managers, peers, or even the individual (Thaler & Sunstein, 2009, p. 145), which has proven beneficial by improving efficiency in such real life cases as Medicare, credit cards, and utilities, such as electricity and water use (Thaler & Sunstein, 2009, pp. 258–259). This method is useful because any reviewer can be sent a monthly statement of an individual's use that not only compares this person to an average or some other form of a scale, but an exact value can be given to the cost of imaging habits. The book also emphasizes that visual nudges, or simply by putting a smiley face or frown face on the statement to reflect the individuals use, can motivate them to conserve, which is seen in *Nudge* by examining a study of 300 houses in San Marcos, California and their associated energy use following either a happy or sad face being placed on their bill. A sad face was placed on their bill if their energy use characteristics were above average and a smiley face if below average. The study found people confronted with symbols of unhappy emotion significantly improved their energy use characteristics (Thaler & Sunstein, 2009, p. 70).

The nudges create incentives for employees to find ways to decrease their use of imaging resources through such things as efficient printing techniques, which is a form of the comparing alternative prices piece of RECAP. These efficient printing techniques can include, but are not limited to, duplex, print preview, and multiple pages

or slides per sheet functions. Efficient printing techniques can be combined with the elimination of needless printing, which can be accomplished by giving a presentation via a projector, utilizing electronic routing software, and employing electronic document libraries instead of the hard copy paper process alternatives.

b. Social Influences

Finally, social influences or the influence caused by others can act as highly effective nudges for three reasons: they provide information, peer pressure, and priming (Thaler & Sunstein, 2009, p. 73). The key to these forms of social influence is that they repeatedly stress the importance of the issue (Thaler & Sunstein, 2009, p. 183). First, information could act as a nudge because people do not receive feedback on the environmental consequences of their actions. Therefore, if a human employee is told one ton of paper is equivalent to about 20 40-foot tall trees, then not only this employee, but fellow employees can picture the cost of their printing (Conserveatree.com, 2010).

The second form of social influence is peer pressure in which coworkers can stress the notion of responsibility to taxpayers and the environment. Realizing that this technique of responsibility to others may not work for some people, employees can also emphasize how efficient printing can benefit the individual. One way in which individuals can benefit is through the spending of money saved on printing costs on items that an individual employee may desire more, such as a new coffee maker in the employee lounge. Lastly, priming is the final form of social influence that can nudge employees. A good example of priming is the pop up that appears when clicking the print icon that asks if an individual wants to use efficient printing techniques to print a document.

D. CONCLUSION

In conclusion, the utilization of an effective MCS is a critical function that enables an organization to help achieve its goals because it provides it with standards that can be used as a benchmark against which to compare (Thaler & Sunstein, 2009, p. 3). Therefore, by strengthening the action controls and implementing personnel and cultural

controls, an “out-of-control” system can be turned into what Merchant and Van der Stede call a “good control system” (Thaler & Sunstein, 2009, p. 11). Additionally, by applying the concept of nudges to the development of the MCS for imaging services, the policies and procedures associated with humans’ procurement and use of imaging hardware and consumables can be greatly improved. These changes to the MCS, including the use of nudges to the choice architecture, can result in more effective control and improved governance of an organization’s employees. Ultimately, this change is more likely to ensure that fiscal resources are more efficiently allocated and consumption of imaging resources is reduced.

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V. CONCLUDING DISCUSSION

A. MPIS SUMMARY

By taking a proactive and directed approach to managing the printing and imaging environment, organizations may be able to reap substantial savings. The corporate and government case studies presented in the first chapter serve as illustrative examples. Aside from achieving an average cost savings of 30 to 40 percent on printing and imaging, organizations can also expect to reduce energy use and consumables consumption, thereby leading to a reduction in TOC by about 30 percent.

One of the most effective ways for an organization to control the printing and imaging environment is to implement a MPIS. MPIS represents the ideal strategy for organizations to assess their current print and imaging environment, monitor current usage and habits, and then gain control of their print and imaging environment. MPIS is not only a comprehensive cost-saving measure; it is also an efficiency enabler that can improve workflow and employee productivity. The strength of a MPIS program lies in its ability to harness three factors critical to managing the print environment: hardware, software, and consumables management.

Optimizing hardware requires three things: 1) that organizations match the technological sophistication of the hardware to their functional needs, 2) that organizations rightsize their hardware fleet, and 3) that organizations, to the greatest extent practicable, homogenize their hardware fleet. The technological enabler that allows organizations to reduce and homogenize their hardware is the MFD, which is capable of copying, printing, scanning, e-mailing, and faxing. Since MFDs have the ability to perform many functions and the ability to handle a high volume of workload, organizations can expect to achieve equal and often greater performance with substantially less hardware.

The software serves as the command and control center for the hardware fleet and is a critical component of a MPIS system because it can provide an understanding of printing habits and trends along with the ability to determine who is printing what and how many copies. Perhaps the greatest strength of the software, however, is its ability to alter print behavior through PMO. The PMO aspect of the software serves not only as an effective MCS, it also serves as a nudge that informs and educates employees and alters their immediate and long-term printing behavior.

In terms of consumables management, organizations can exert centralized control over the purchasing process. By implementing preaction reviews and action controls, an organization can prevent stockpiling and out-of-control consumables purchasing practices for printing and imaging supplies that plague greater than 90 percent of the companies in America (Marshall, 2010, p. 23). The results of the centralized control are less unnecessary purchases, a more manageable inventory, and an immediate, as well as long-term savings, which frees up budget dollars that can be used elsewhere.

Whether in the public or private sector, MPIS can benefit an organization in a variety of different ways from cost savings, to increasing productivity, to even reducing negative environmental impacts. Another benefit of implementing a MPIS is the speed at which beneficial results can be obtained because the printing and imaging environment is rarely managed (Collett, 2010, p. 2). Therefore, the first successful attempt at managing the print and imaging environment yields the greatest returns, while subsequent and continual management efforts yield less and less returns as an optimum print and imaging environment is reached. As demonstrated in the Chapter I, cost savings on consumables can be realized in as little as a month while more sizeable and noticeable benefits can be observed and obtained in six months to a year. Thus, for these reasons, implementing a MPIS initiative represents an intelligent, viable, and cost effective way of managing and controlling the print and imaging environment.

B. NAVSISA RESULTS SUMMARY

Applied specifically to the three buildings of NAVSISA, implementing a MPIS program could potentially save the command an estimated $657,734, or 50 percent of the current expenditures, over the three-year period, which would equal approximately $219,244 in cost savings per year. Significant savings are achieved in such cost categories as devices, ink, paper, and energy.

	Step	Cost Comparison	Current	MPIS
Phase 3	1	Cost of Devices	342,000	142,000
	2	Cost of Ink	267,972	99,861
	3	Paper Costs	48,000	36,000
	4	Maintenance Cost	30,966	71,000
	5	Maintenance-Person Cost	300,000	0
	6	Wall-Drop Installation Costs	0	0
	7	Wall-Drop Service	166,320	54,180
	8	Installation Costs	114,684	21,629
	9	Certification and Accreditation Costs	0	66,000
	10	Training Costs	0	45,260
	11	Energy Cost	33,855	5,967
	12	Intangible Costs Of Changing To MFDs	0	104,166
	13	Storage Costs	0	0
	14	Disposal Costs	0	0
	Total		**1,303,797**	**646,063**

Figure 12. Phase 3 of Independent Cost Estimate for NAVSISA

Aside from the tremendous economic benefits NAVSISA can obtain with a MPIS program, NAVSISA can also achieve tremendous hardware homogenization and streamlining. NAVSISA's current print and imaging environment consists of 28 different models of printers, with a user to device ratio of approximately 3 to 1. By using an industry recommended user to device ratio of 20 to 1, the number of devices can be reduced to 43 while homogenizing the printers down to two different varieties—one for color, and one for black and white. This reduction in the need for imaging devices results in a significant cost savings. As a logical extension, the varieties and quantities of ink or toner cartridge would be homogenized and streamlined as well, leading to additional money saved. By installing and utilizing MPIS software, nudges, such as defaults and

PMO print screens, can begin to exert steady influence over the printing behavior of the employees, which can lead to lower paper consumption by changing the printing habits and the culture of the workforce. The results of the potential cost savings at NAVSISA are notable, yet are not uncommon for organizations that have implemented a MPIS. If similar results can be obtained throughout the Navy's Echelon II, III, and IV commands, possible savings could reach well over $100 million.

C. RISKS, LIMITATIONS, AND HURDLES

1. Risks

Although a MPIS offers a robust solution to managing the print and imaging environment, a MPIS does not come without the risks associated with the installation of IT equipment. It is, therefore, of paramount importance to have a program to identify and mitigate the possibilities of those risks (DeSalle & Schilling, 2006, p. 41). Even though single function devices can be a part of an effective MPIS program, superior results are usually obtained by employing MFDs capable of utilizing the entire suite of functions beyond printing and copying—namely, scanning, faxing, and e-mailing. The introduction of these functions, however, also introduces risks that do not exist with single function devices. The two major types of risks are network attacks and physical attacks (Urbanski, 2010, p. 2).

For network attacks, the first risk is the corruption of network security by an external attack. By activating and enabling the use of fax capabilities in a MFD, "there could be a potential vulnerability with respect to the phone line going into that machine, [such that] if the phone line is not secured, a potential adversary could access the computer network through the open telephone/fax line on the device" (DeSalle & Schilling, 2006, p. 41). The hacker would then be able introduce a virus, worm, or Trojan Horse to corrupt the integrity of the network. To mitigate this risk, MFDs should have security assurances (such as common criteria certification) that ensures the separation between the network and phone line circuitry on the device.

A second risk, also associated with network security, is an internal attack on the network using the MFD itself as "a disgruntled employee could use one of the devices to launch an internal network attack" (DeSalle & Schilling, 2006, p. 41). This disgruntled employee, could for example, send malicious e-mails as a means of corrupting the network without it being traced back (xerox.com, 2008, p. 2). To mitigate this risk, network administrators must "maintain their vigilance over the network through the various monitoring tools, as well as a robust training program geared at security, prevention, and information awareness" (DeSalle & Schilling, 2006, p. 42). Specific actions include enabling and using firewalls for networked printing and imaging devices, password protecting the printer at both the machine itself (control/menu console) and through a web interface, if applicable (Urbanski, 2010, p. 3).

One of the strengths of the MPIS software suite is that it acts as the control center for the peripheral devices. The software continually monitors the activity and performance of the devices and can alert the network administrator of unusual activity or problems occurring with a device, such as network attacks. The software does not eliminate the risk, but it does significantly mitigate the risk.

To mitigate the physical risks from a MFD attack, network administrators should ensure that user access and rights to the MFDs are limited to allow only the most basic and necessary functions associated with printing and copying (Urbanski, 2010, p. 1). A potential risk associated with not restricting access rights to the MFD is an accidental form of denial of service. Some employees could tinker with the electronic menus of a MFD in an effort to alter their print output, say the size or contrast. If they are not completely familiar with the device, they may inadvertently alter security settings or disable critical functions, causing an accidental malicious configuration and send the machine offline. Although there was no intent, malicious or otherwise, it is still a denial of service, albeit a quickly correctable one. To mitigate these risks, IT administrators should password protect the control and menu panels to prevent unauthorized or accidental configuration changes (Urbanski, 2010, p. 4).

Another potential risk related to a denial of service is an electronic or mechanical breakdown of a MFD. In a print and imaging environment in which over 100 printers or copiers exist, redundancy is usually not a concern. However, for a MPIS program in which the hardware fleet is streamlined to the maximum extent possible, a nonfunctioning machine could significantly increase the user to device ratio. Consider, for example, a workforce composed of 40 employees with two MFDs. The user to device ratio in this case is 20 to 1. If one of the devices were to stop working, the functioning MFD would have to absorb the remaining workload and the new user to device ratio would be 40 to 1, which represents an increase of 100 percent. However, as the workforce grows, the effect of one malfunctioning machine on the user to device ratio diminishes, as can be seen in Figure 13. Aside from routine and preventative maintenance, not much else can be done to mitigate this risk.

# of Employees	# of Working Devices	User to Device Ratio	# of Broken Devices	# of Working Devices Remaining	New User to Device Ratio	% Increase in User to Device Ratio
40	2	20	1	1	40	100%
60	3	20	1	2	30	50%
100	5	20	1	4	25	25%
200	10	20	1	9	22	11%
400	20	20	1	19	21	5%

Figure 13. Percentage Increase in User Device Ratio as a Result of 1 Broken MFD

A final physical risk is a potential breach of personally identifiable information (PII), such as social security numbers and employee evaluations. Reproductive office equipment, such as MFDs produced in the past seven years, typically have hard drives that store images that have been scanned, faxed, printed, or copied (United States, Department of the Navy, 2009. p. 1). If the proper security protocols are not in place, a malicious attacker may possibly remove the hard drive from the MFD and gain access to

the documents on the disk. To mitigate these risks, the Department of the Navy Chief Information Officer (DoN CIO) recommends the following (United States, Department of the Navy, 2009. p. 1).

- Identify the hard drive capabilities of photographic equipment and educate office personnel with that information.
- For government-owned equipment, hard drives should be removed and physically destroyed prior to disposal. Hard drives are not easily accessible, so removal will probably require a technician to accomplish.
- For leased equipment, the hard drives should be reformatted to remove all data on printer/copier hard drives. Refer to the manual or service technician for the reformatting process. Future DoN guidance may address new vendor contract language that requires removal and physical destruction of the hard drive before the equipment leaves government control.
- Place a sticker or placard on the copier/printer with a banner: "Warning, this government-owned copier uses a hard drive that must be physically destroyed prior to turn-in" or "Warning, this leased copier uses a hard drive that must be reformatted prior to turn-in." This sticker serves as a poka-yoke, as mentioned in Chapter IV.

A breach of PII can also result from documents that are printed and forgotten at the MFD. A supervisor can, for example, print several employee evaluations, and in the middle of that process, receives a call from the boss, causing the supervisor to forget about the print job. The unattended evaluations can lead to a potential risk of the PII, since it is common to pick up documents accidently belonging to a coworker at a printer or copier (xerox.com, 2008, p. 3). The most effective method for mitigating this risk is to require the use of an individual's common access card (CAC)/ID card or the use of a PIN to release the document. Thus, if a supervisor does not release the document, it will remain in the print queue and will not be seen or taken by unauthorized employees.

2. Limitations

Aside from risks associated with implementing a MPIS program, there are also limitations that potentially prevent the full optimization of a MPIS program within the DoN specifically. These limitations are categorized into three areas: capability, security,

and contracting. In terms of capability, the greatest limiting factor is that not all the functional applications of a MFD can be used as intended. The technical strength and appeal of a MFD is its ability to provide printing, copying, faxing, and scanning to e-mail capabilities in a single unit efficiently, while providing cost savings by eliminating unnecessary redundancies in hardware and consumables. Presently, none of the MFDs that appear on the NMCI certified device list are allowed to operate with all four capabilities on the Navy's NMCI network. Out of 48 certified MFDs, only seven are certified for print, copy, and fax. Currently, no MFDs allow for the use of the scan to e-mail function (Homeport.navy.mil, 2010, p. 1). In spite of this limitation, cost savings can still be achieved because the majority of the resource-related costs are tied to the use of consumables for the print and copier functions.

The driving factors that limit the full use of MFD capabilities are NMCI security requirements for software and hardware—specifically, the C&A process. The C&A process is a process "by which federal agencies are required to apply a process of formal assessment, testing (certification), and acceptance (accreditation) of system security controls that protect information systems and data stored in and processed by those systems" (United States, Office of Management and Budget, 2009, p. 13). The C&A process "applies to all agency-owned or contractor systems operated on behalf of a federal agency" (United States, Office of Management and Budget, 2009, p. 13). A successful certification is a formal declaration that the software or hardware is allowed to operate on the network at an acceptable level of risk, while a successful accreditation results in an authorization for software or hardware to process, store, or transmit information (United States, Government Accountability Office, 2006, p. 8). The primary problem with the C&A process is that it is a very complex and lengthy evolution that can take anywhere from a few months up to two years to complete (Novadatacom.com, 2010, p. 11). During this timeframe, the benefits of the system undergoing the C&A process cannot be utilized. Further exacerbating the problem are the financial costs associated with the C&A process, which can be as high as $83,000 (Sans.org, 2007, p. 6). The C&A process also limits the Navy from a contracting standpoint. Although MPIS is usually contracted to a third-party

vendor, the Navy could potentially run a MPIS program in-house so long as it had the right software and it was cost effective to do so. Currently, no MPIS software programs are certified for use on the NMCI network. Therefore, contracting would not be able to negotiate a MPIS software licensing agreement for in-house use. In addition, since MPIS software is not certified, contracting is also not able to negotiate for third-party vendors to provide the MPIS service.

Another potential limitation is the contracting branch's inexperience with the pricing model used by MPIS providers (since the Navy does not have any existing MPIS contracts). MPIS providers use a complex and unfamiliar pricing scheme that includes a fixed-fee for hardware and a per-click charge for services. Many organizations do not have the expertise to devise or negotiate such an agreement (Marshall, 2010, p. 23). The price schedule is tiered and based on a volume commitment. If contracting is too aggressive in its estimation and volume limits are exceeded, a higher price is triggered, which is analogous to a cell phone pricing agreement in which the price per minute charge is significantly higher once the agreed upon limit is exceed. Just as it took time for the Navy to learn and effectively negotiate cell phone contracts, the Navy will likely go through the same process with a MPIS contract.

3. Hurdles

Perhaps the greatest hurdle to managing the print and imaging environment is the lack of visibility that a print and imaging environment receives within an organization. One of the primary reasons that the print and imaging functions in an organization go unchecked and unmanaged is because no single entity within an organization governs the totality of the print and imaging environment. Without an entity to be held responsible for the print and imaging environment, no effective way could be identified to understand what the total expense to manage that environment is, much less the finer details, such as the cost of devices, the cost of consumables, or the cost of maintenance. Therefore, it is important to assign responsibility to a department while simultaneously delineating its

associated duties and responsibilities. Incidentally, one of the strengths of hiring a MPIS provider is shifting the responsibility for managing the print and imaging environment to a single entity.

A corollary to the lack of visibility is a lack of awareness of the employees regarding their individual and collective printing and imaging habits. If no one is managing the print and imaging environment, then the organization is essentially depending on the employees to self-monitor their use or abuse of the resources in relation to that environment. Along with assigning responsibility for the print and imaging environment, an organization can also conduct a cost analysis of its current printing and imaging environment, as shown in Chapters II and III. The results of the analysis should at a minimum shed light on the issue and raise the organization's awareness of the print and imaging environment.

Once visibility and awareness are addressed, the final hurdle to tackle is employee resistance to change. Implementing MCS changes will always create costs, whether direct or indirect. The indirect costs are focused upon because the direct, or out of pocket financial cost of implementing the changes, should be more than offset by the savings created by a better managed imaging service (Merchant & Van der Stede, 2007, p. 179). Additionally, the indirect costs of action controls are also focused upon because personnel and cultural controls have relatively few harmful side effects (Merchant & Van der Stede, 2007, pp. 179, 221).

The indirect costs of action controls revolve around behavioral displacement, or the concept that people tend to act in their own best interests and not in the best interests of the organization (Merchant & Van der Stede, 2007, p. 180) because people tend to consume more than they otherwise would, given that they actually do not have to pay for imaging services themselves (Pharos.com, 2006, p. 2). Next, negative attitudes accompany any change in an organization because push back and frustration are natural reactions to change (Pharos.com, 2006, p. 188). Additionally, based on the authors' experience in the Navy, it is necessary to worry about gamesmanship because as soon as a control is implemented, Sailors almost instinctively look for ways to circumvent it.

Change management will always be an issue but change can be facilitated by implementing a MCS and nudges, as discussed in Chapter IV. The results of the ICE might also be enough to compel employees to alter their behavior. For some employees, it is the knowledge that the MPIS software (if installed) is tracking their printing behavior. For others, it might be a compelling request from senior leadership or the fact that they are simply made aware of the problem. The best approach is a holistic one that aims to increase visibility, raise awareness, and facilitate change by the appropriate use of a MCS and nudges.

D. RECOMMENDATIONS

Although risks, limitations, and hurdles do exist that prevent the implementation of a full-fledged MPIS program, proactive steps can still be taken. These steps can facilitate a rapid and successful execution of a full MPIS program once the limitations and hurdles have been cleared. In light of this, four recommendations are offered.

1. Do What You Can Now

This broad recommendation recognizes that as powerful as a full MPIS program is, benefits can still be attained by performing portions of the program. To overcome the visibility and awareness hurdle, organizations should conduct an ICE to understand the characteristics of their print and imaging environment. Once the results of the ICE are calculated, the organization can use that information to design effective controls and nudges to facilitate a successful MPIS program. These actions include the following.

- Assigning responsibility for the print and imaging environment
- Centralizing purchasing responsibility or oversight for hardware, software, and consumables
- Streamlining the hardware fleet if possible
- Setting reduction targets for paper and ink consumption
- Setting printing and copying defaults to print double sided
- Educating and training the workforce on the benefits of a MPIS

Taking these actions can go a long way towards gaining control of the print and imaging environment and results in an effective in-house MPIS.

2. Determine the Feasibility of Certifying MPIS Software

Despite the potentially lengthy and costly process of certifying MPIS software, a potential high return on investment might occur if the Navy could license MPIS software and run the entire program in-house. The software, combined with the previous steps, represents a fully functional MPIS program. If commands could successfully and consistently run MPIS programs in house, this might serve as the ideal model for running a MPIS program throughout the Navy, as opposed to contracting this function out to third-party providers.

3. Have Contracting Begin Researching MPIS Pricing Schedules

Even though MPIS is currently not available for use on the NMCI network, contracting should still research MPIS pricing schemes and schedules to become familiar with them and to understand fully the intricacies of the MPIS market. Should the opportunity become available to contract for MPIS software or services, contracting would be better prepared to negotiate for the best possible combination of prices and services.

4. Conduct a Pilot Program Once MPIS Becomes Available for Use on the NMCI Network

Before committing to a large-scale MPIS effort, it would be prudent to record a series of small successes to test the feasibility of running a MPIS program enterprise wide. This effort is simply a good business practice and a risk management tool. Thus, if MPIS fails to deliver, losses can be cut.

E. AREAS FOR FUTURE RESEARCH

While MPIS has become a popular way for many businesses to gain control of their print and imaging environment, the Navy's understanding of how MPIS can benefit the enterprise is still in the beginning stages. As a MPIS program has yet to be

implemented, no in-house body of knowledge of actual cost savings achieved or benefits gained exists. Once MPIS is implemented and data is collected, new avenues and topics for research may present themselves. However, within the risks and limitations previously mentioned, lie the seeds of further research that can still be conducted. In terms of network security, further research should be conducted to determine the best way to incorporate and allow the e-mail functionality of a MFD so that the full functionality of the machine can be utilized. Further research should also be conducted on the best way to prevent attacks via a MFD. This effort should always be ongoing as hackers are continually conducting their own research on ways to exploit network security.

Research should also be conducted to determine if the C&A process can be streamlined from its currently cumbersome state. Successfully reducing the length of time and costs required for the C&A process could lead to quicker access to beneficial information systems, hardware, and software, which would not only benefit the MPIS program specifically but the entire IT domain.

The final area for further research is in the realm of contracting. As mentioned in Recommendation 3, research could be conducted to determine the best possible combination of pricing and services that would benefit the Navy. Would the best option be to contract out the entire MPIS program, portions of the MPIS program, or license the MPIS software program and run MPIS in-house?

For the Navy, a MPIS program represents an untapped frontier of cost saving initiatives. Implementing MPIS is a logical step for the Navy to take in its effort to assess, manage, and control its print and imaging environment. It represents a viable and effective way for the Navy to not only revolutionize and modernize a specific aspect of its business processes, but to also save considerable amounts of operating dollars in an ever more restrictive fiscal environment.

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APPENDIX A

Example Checksheet

	Step	Start Process	Result	Notes
Phase 1	**1**	Identify an Assessment Team		**Identified By Management**
	2	Identify Scope		
	3	Track Cost Assessment		

	Step	Required Info	Result	Notes
Phase 2	**Current Imaging System**			**To Be Determined by Assessment Team**
	1	# of Printers/Copiers at Organization		**See Phase 2 of Chapter 2 for Detailed Instructions on How to Calculate Each Line Item**
	2	Total Cost of Devices		
	3	Refresh Cycle		
	4	Ink costs Per Year		
	5	# of Pages Printed by Organization Per Year		
	6	Cost of Paper Per Box		
	7	Paper Cost Per Year		
	8	Maintenance Cost Per Year		
	9	Maintenance-Person Cost		
	10	Total Wall Drop-Installation Cost		
	11	Total Wall-Drop Service Per Year		
	12	Device Installation Costs		
	13	Certification and Accreditation Costs		
	14	Training Costs		
	15	Energy Costs		
	16	Storage Costs		
	17	Disposal Costs		

	Step	Required Info	Result	Notes
Phase 2	**Managed Print And Imaging Service**			**To Be Determined by Assessment Team**
	18	# of People at Organization		**Can Be Obtained Using Similar Processes Described in Steps for Current Imaging Process or From the MPIS Contract Bids.**
	19	Organizations Footprint in sq. ft.		
	20	Determine # of MFDs Needed		
	21	Get Bids From At Least Two Different Providers		
	22	Cost of MFDs		
	23	Cost of Ink		
	24	Cost of Paper		
	25	MFD Maintenance Cost		
	26	Maintenance-Person Cost		
	27	Total Wall-Drop Installation Cost		
	28	Total Wall-Drop Service Per Year		
	29	Total Device Installation Cost		
	30	Certification and Accreditation Costs		
	31	Training Costs		
	32	Energy Cost		
	33	Intangible Costs of Changing to MFDs		
	34	Storage Costs		
	35	Disposal Costs		

	Line Item	Cost Comparison	Current	MPIS
Phase 3	**1**	Cost of Devices		
	2	Cost of Ink		
	3	Paper Costs		
	4	Maintenance Cost		
	5	Maintenance-Person Cost		
	6	Wall-Drop Installation Costs		
	7	Wall-Drop Service		
	8	Installation Costs		
	9	Certification and Accreditation Costs		
	10	Training Costs		
	11	Energy Cost		
	12	Intangible Costs of Changing To MFDs		
	13	Storage Costs		
	14	Disposal Costs		
	Total			

APPENDIX B

Check Sheet Applied to NAVSISA

	Step	Start Process	Result	Notes
Phase 1	**1**	Identify an Assessment Team	Complete	**Identified By Management**
	2	Identify Scope	Complete	
	3	Track Cost Assessment	In Progress	

	Step	Required Info	Result	Notes
	Current Imaging System			**To Be Determined by Assessment Team**
Phase 2	**1**	# of Printers/Copiers at Organization	228	**Can Be Obtained By Conducting A Three Month Study**
	2	Total Cost of Devices	342,000	
	3	Refresh Cycle	3	
	4	Ink costs Per Year	89,324	
	5	# of Pages Printed by Organization Per Year	2,000,000	
	6	Cost of Paper Per Box	40	
	7	Paper Cost Per Year	16,000	
	8	Maintenance Cost Per Year	10,322	
	9	Maintenance-Person Cost	100,000	
	10	Total Wall-Drop Installation Cost	0	
	11	Total Wall-Drop Service Per Year	55,440	
	12	Device Installation Costs	114,684	
	13	Certification and Accreditation Costs	0	
	14	Training Costs	0	
	15	Energy Costs	11,285	
	16	Storage Costs	0	
	17	Disposal Costs	0	

	Step	Required Info	Result	Notes
	Managed Print And Imaging Service			
Phase 2	**18**	# of People at Organization	869	**Can Be Obtained Using Similar Process Described in Steps for Current Imaging Process or From the MPIS Contract Bids.**
	19	Organizations Footprint in sq. ft.	162,000	
	20	Determine # of MFDs Needed	43	
	21	Get Bids From at Least Two Different Providers	Complete	
	22	Cost of MFDs	142,000	
	23	Cost of Ink	33,287	
	24	Cost of Paper	12,000	
	25	MFD Maintenance Cost	71,000	
	26	Maintenance-Person Cost	0	
	27	Total Wall-Drop Installation Cost	0	
	28	Total Wall-Drop Service Per Year	18,060	
	29	Total Device Installation Cost	21,629	
	30	Certification and Accreditation Costs	66,000	
	31	Training Costs	45,260	
	32	Energy Cost	1,989	
	33	Intangible Costs of Changing To MFDs	34,722	
	34	Storage Costs	0	
	35	Disposal Costs	0	

	Line Item	Cost Comparison	Current	MPIS
Phase 3	1	Cost of Devices	342,000	142,000
	2	Cost of Ink	267,972	99,861
	3	Paper Costs	48,000	36,000
	4	Maintenance Cost	30,966	71,000
	5	Maintenance-Person Cost	300,000	0
	6	Wall-Drop Installation Costs	0	0
	7	Wall-Drop Service	166,320	54,180
	8	Installation Costs	114,684	21,629
	9	Certification and Accreditation Costs	0	66,000
	10	Training Costs	0	45,260
	11	Energy Cost	33,855	5,967
	12	Intangible Costs of Changing to MFDs	0	104,166
	13	Storage Costs	0	0
	14	Disposal Costs	0	0
	Total		**1,303,797**	**646,063**

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